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BULLETIN

OF THE

DEPARTMENT OF AGRICULTURE.

Vol. IV.

FEBRUARY, 1906.

Part 2.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.,

Director of Public Gardens and Plantations.

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P R I C E—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send name and address to the Director of Public Gardens and Plantations, Kingston P.O.

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BULLETIN

OF THE

DEPARTMENT OF AGRICULTURE.

Vol. IV.

FEBRUARY, 1906.

Part 2.

**SOME BANANA SOILS OF ST. MARY AND
UPPER ST. CATHERINE.**

By **H. H. COUSINS, M.A.,** Government Chemist.

At the suggestion of the writer, the Board of Agriculture arranged that Mr. Cradwick should take a number of soil samples from typical cultivations of the smaller planters in St. Mary for partial Analysis in the Laboratory, so that advice might be given as to the need of drainage, humus, or lime in each case; our previous Analyses and experiments having indicated that the banana soils of St. Mary are not in present need of commercial fertilizers, but require special attention to drainage and humus and in some cases lime, it appeared desirable that a good number of typical soils should be examined to this end.

Mr. Cradwick made a special visit to St. Mary * and early in 1905 sent in 51 examples of soil to the Laboratory, with observations as to the conditions he noticed in each case.

Unfortunately several of the samples were labelled with perishable labels and only 39 samples were capable of being identified.

These have been examined as to

A. Mechanical condition.

B. Percentage of Lime as Carbonate.

C. Percentage of Humus, soluble in Ammonia, and the results are here given. Mr. Cradwick's original observations being quoted in each case.

* Mr. Cradwick's Report will be found in *Bulletin* Oct. 1905, page 220. *Editor, Bulletin.*

A.—RIO MAGNO—ST. CATHERINE:

["Soil from the bank near River, Bananas poor, cocoa very poor."]

No. 1—*Surface Soil.*

Sample lost.

No. 2—*Subsoil.*

Lime as carbonate	...	Abundance
Humus	...	1.28%
Mechanical condition	...	Clay, loam

Observations.

From a previous sample examined in the Laboratory from the same source, it was found that this soil was variable, some patches being very good soil for bananas and others below par in humus and general fertility.

The soil does not lack lime.

No. 3—*Surface soil.*

["Near Immortelle nursery, between house and river, poor bananas, cocoa worse".]

Lime as carbonate	...	Abundance
Humus	...	2.23%
Mechanical condition	...	Clay, loam

Observations.

This soil does not lack lime and the humus is fairly good.

The soil is inclined to be heavy and *drainage* is probably the factor required to ensure a good and vigorous growth of bananas and cocoa.

The subsoil sample was lost, but there are indications, that the subsoil here is impervious and that deep drains would be necessary to enable the cocoa roots to penetrate and develop.

No. 5—*Surface soil.*

["From corner near cow-pen, good bananas and good cocoa."]

Lime as carbonate	...	1.25%
Humus	...	4.16%
Mechanical condition	...	Stiff clay

Observations.

The humus in this case is very high and despite the stiff nature of the soil, the results of the cultivation are reported as satisfactory.

If well drained, this soil should be of very high fertility.

There is abundance of lime and an unusual amount of humus.

HAMPSTEAD—ST. MARY.

No. 7—*Surface soil.* (Missing).No. 8—*Subsoil of No. 7,*

["Just inside gate—a spot where nothing has thriven, the proprietor says it is improving from the application of banana trash."]

Lime as carbonate	...	Abundance
Humus	...	0.36%
Mechanical condition	...	Clayey marl

Observations.

This soil is almost devoid of humus and one that would absorb an enormous amount of vegetable matter without greatly improving its nature.

It is doubtful whether soils of this type can be profitably cultivated for bananas.

No. 9—*Surface soil.*

["Near by cotton tree—everything thrives here, but I think more drainage would improve the bearing of cocoa.

Bananas very fine and very large cocoa pods on some trees grown from seedlings from Hope Gardens."]

Lime as carbonate	...	Abundance
Humus	...	4.4%
Mechanical condition	Stiff soil, inclined to clay	

Observations.

This soil is very rich in humus and contains an abundance of lime.

Mr. Cradwick's suggestion as to deeper drainage can be confidently supported.

This soil is worth handling on intensive lines of cultivation and has a large reserve of banana-producing power to draw upon.

The contrast between this soil and the previous one is very striking.

No. 11—*Surface soil.*

["From spot where bananas give good bunches but do not finish up well. Cocoa does not grow in spite of being near a big guango."]

Lime as carbonate	...	Abundance
Humus	...	3.37%
Mechanical condition	...	Heavy clay

No. 12—*Subsoil of above.*

["This land wants more drainage."]

Observations.

This soil only needs deep drainage to produce excellent results.

The humus is well up to standard. In my opinion this soil would repay the cost of deeper drainage and intensive cultivation.

No. 13—*Surface soil.*

["One of the spots I suggested as no use wrestling with, better plant some good trees and grass on it."]

Lime as carbonate	...	Very high
Humus	...	4.4%
Mechanical condition	...	Clayey loam

Observations.

This soil is so rich in humus that if adequate drainage is practicable, it should grow good fruit.

A trial should be given of this before abandoning the land to grass.

No. 15—*Surface soil.*

["Spot where the Laboratory has been experimenting with manures."]

["Very poor and 'shotty,' has improved with manure but still looks pretty bad. The bananas look spotty and thriftless, do not bear, and have a lot of little round galls or warts on them.

The manure has grown about the finest Spanish needle I have ever seen."]

Lime as carbonate	...	Excessive
Humus	...	0.95%
Mechanical composition		Clay marl

Observations.

This soil is quite unsuited for bananas by nature, and in my opinion will not repay the heavy applications of vegetable refuse and manure that would be required to enable it to produce good fruit.

No. 17.—*Surface soil.*

["'Pasture Piece,' a field of young cocoa, about 3 years old, most of which are growing nicely. The land has some drains, but they are not systematic, and I recommend, in order to make a success of this field, that contour drains at intervals of not more than 24 feet should be put in."]

Lime as carbonate		Abundance
Humus	...	4.25%
Mechanical condition—Stiff clay with similar subsoil.		

Observations.

A first class soil, but demanding deep drainage. Unless this is attended to the cocoa will probably fail after a few years.

HIGHGATE, ST. MARY.

No. 21.—*Surface soil.*

["'John's Piece,' where cocoa is growing well. More drainage would improve the bearing. Fine bananas were growing on this land, but shelter trees would be useful both for bananas and cocoa."]

Lime as carbonate	...	1.25%
Humus	...	2.57
Mechanical condition—Stiff—inclined to clay, with similar subsoil.		

Observations.

Drainage is clearly essential. The humus is good, but might be higher to advantage. The soil does not lack lime.

No. 23.—Surface Soil.

["Bananas and cocoa, 2 years old, nearly all look poorly. This sample is not taken from the worst spots, which I have advised to be thrown up and planted in trees and grass to provide manure for the better land from which the sample was taken."]

Lime as carbonate	...	1.0%
Humus	...	3.2%
Mechanical condition—Stiff clay with similar subsoil.		

Observations.

With drainage this soil should grow good bananas. The humus in this sample is higher than in the previous one reported upon (No. 21).

ORACABESSA A. ST. MARY.

No. 25.—Surface soil.

["Very mixed cultivation of good bananas, cocoa, coffee and coco-nuts. Bananas are very fair as ratoons, but late, and the proprietor says are late every year. Well-drained land, but not forked since the prize-holding contest of three years ago."]

Lime as carbonate	...	2.75%
Humus	...	2.84%
Mechanical condition—Stiff, inclined to clay.		

Observations.

This land is in good heart, but would give better results with more tillage. This land should be forked thoroughly and a supply of green manure secured, so as to maintain the standard of humus.

No. 27.—Surface soil.

["From heavy flat, near house, bananas grow well here, but are also late. I have suggested that bananas on this land should be replanted oftener and particular attention be paid to drainage. Trash, which is very easy to obtain, should be applied as heavily as possible, and the land receive a dressing of lime."]

Lime as carbonate	...	2.25%
Humus	...	3.39%
Mechanical condition—Stiff, inclined to clay.		

Observations.

The analysis shows that this soil contains abundance of lime.

The addition recommended by Mr. Cradwick might prove of advantage in making the soil more friable, but it would tend to a somewhat rapid loss of humus.

Drainage and tillage are obviously the chief requirements.

The present standard of humus is quite good for an average banana soil.

ORACABESSA, B.

No. 29.—Surface soil.

["Bananas planted July, 1904. Drained and in good health, but in many spots the bananas are coming on very slowly."]

Lime as carbonate	...	1.25%
Humus	...	3.39%
Mechanical condition—Stiff soil, with very stiff clay subsoil.		

Observations.

The indications are that more drainage would remedy the defect noted by Mr. Cradwick.

The lime and humus are quite satisfactory.

HIGHGATE B.

No. 31.—Surface soil.

Lime as carbonate	...	2.5%
Humus	...	3.0%
Mechanical condition—Stiff clay.		

No. 33.—Surface Soil.

Lime as carbonate	...	1.0%
Humus	...	2.32%
Mechanical condition—Medium clay.		

Observations.

No. 31 is a good soil for bananas if well drained.

No. 32 is somewhat deficient in humus.

There is no deficiency of lime. Drainage is the chief factor to be considered in the cultivation of these soils.

No. 35.—Surface Soil.

["A fair sample of many 'gall spots' which appear in the midst of very good land, fruit is both small and late.

A manure that would increase the size of bunches and bring in the fruit earlier is much needed"].

Lime as carbonate	...	3.0%
Humus	...	1.84%
Mechanical condition—Light soil of medium texture.		

Observations.

The humus in this soil is below par, and it is very doubtful whether any manure other than farmyard manure would do much good.

Galls are often a temptation to the use of extravagant manuring that the crop cannot pay for and in many cases are best left alone.

PORT MARIA.

No. 37.—Surface soil.

["From cocoa walk near house. I have suggested as a first step, systematic drainage, forking right through the land, manuring with trash or any kind of manure available, together with Lime and the replanting of the bananas.

The cocoa here was badly damaged by the hurricane.”]

Lime as carbonate	...	1.62%
Humus	...	2.86%
Mechanical condition—Very stiff clay with impervious sub-soil.		

Observations.

All Mr. Cradwick's proposals, with the exception of the use of lime, are fully supported from the Laboratory observations.

This is a very heavy soil and would be benefited by deep drainage and tillage and the humus could be increased to advantage.

PORT MARIA—B.

No. 39 40.—*Surface and Sub-soil.*

[“From a spot where bananas practically go to nothing, it is drained very irregularly to a depth not exceeding 18 inches.”]

Lime as carbonate	...	Considerable.
Humus	...	3.07%
Mechanical Condition—Stiff clay with light coloured clay marl, sub-soil.		

Observations.

This soil cannot be expected to grow good fruit without a really deep and efficient system of drainage.

Considering the amount of chalk in the soil, the Humus must be considered good.

This is a type of soil on which bananas grow with difficulty and if all the land were similar to this, it would be expensive to work and the results probably disappointing.

RIVERSDALE.

No. 41 & 42.—*Surface and Sub-soil.*

[“From Banana Walk, Eastern slope—Bananas four years old, good stems but damaged by winds.

Land wants draining and cultivating only.”]

Lime as carbonate	...	0.61%
Humus	...	1.55%
Mechanical condition—Red soil, stiff clayey loam, with similar sub-soil.		

Observations.

This soil is deficient in Humus and a heavy covering of refuse manure should prove beneficial.

Drainage is obviously necessary. The soil is capable of great improvement.

No. 43 & 44.—*Surface soil and Sub-soil.*

["From flat near house; Bananas not so good. Land wants draining and manuring."]

Lime as carbonate	..	Nil.
Humus	...	0.89%
Mechanical condition—Clay loam, with similar sub-soil		

Observations.

This soil is entirely deficient in chalk, and should be treated with half a ton of lime each year. The humus is so low, that bananas cannot be expected to grow.

Heroic measures are required to improve this serious deficiency.

Drainage is also imperative. As compared with the previous soil, this presents far greater difficulties in converting it into good banana land.

HIGHGATE C.

No. 47.—*Surface soil.*

["From Orange River field about the centre where cocoa trees look well."]

Lime as carbonate	...	1.87%
Humus	...	5.09%
Mechanical condition—Stiff clay soil.		

Observations.

A soil with a splendid standard of Humus and containing abundance of chalk. Retentive and demanding drainage.

No. 48.—*Surface soil.*

["Higher up the same field where the cocoa looks middling"].

Lime as carbonate	...	1.87%
Humus	...	3.11%
Mechanical condition—Stiff loam.		

Observation.

This soil only has $\frac{3}{8}$ as much humus as the previous sample and this would account for the trees not doing quite so well.

No. 49.—*Surface soil.*

["Top of the same field, cocoa trees poor, much exposed to wind or rain.

There the trees require a good wind-brake to protect them.

I would suggest as an experiment that the proprietor should drain a small section of this land to an extent that might even seem extravagant"].

Lime as carbonate	...	1.75%
Humus	...	2.56%
Mechanical condition—Stiff clay.		

Observations.

● A comparison of the three last soils will illustrate how in the tropics, the upper area of hills in cultivation get washed and poor in Humus, while a progressive enrichment is found in the lower levels. All these soils indicate the desirability of drainage.

They do not need lime. The humus of the upper portion is so much less in amount than that of the lower, that it is not surprising that the cocoa should be poor, apart from the exposure to wind which Mr. Cradwick has pointed out. Any drainage works would have to be carried out at a carefully adjusted gradient and the washings carefully replaced on the soil. Every effort should be directed towards reducing loss of fertility in the upper area.

CONCLUSIONS.

These soils indicate that the original idea upon which the work was based is sound, viz:—

That in most cases the needs of the banana soils in St, Mary and the neighbouring districts are not chemical fertilizers, but rather—

- (i) Drainage
- (ii) Humus
and in some cases
- (iii) Lime.

Mr. Cradwick is to be congratulated upon the way in which his advice has been generally supported by the conclusions derived from the subsequent examination of the soils in the Laboratory, as is here evident and it is hoped that this work may be extended in the future so that a large number of the smaller cultivators may be advised as to the practical treatment of the soils on their holdings.

HOPE GARDENS.

The cultivated area at the Hope Gardens contains not only an ornamental garden but also an Experiment and Teaching Station.

The first beginning of an Experiment Station at Hope was in 1874 under Mr. Robert Thomson. The Government came into possession of 200 acres of land there in 1873, and determined to transfer the new varieties of Sugar Cane, received from the Botanic Gardens of Mauritius and Martinique and planted in the small garden at Castleton, to the ample area at Hope. Nearly 18 acres were put under Cane in 1874, and 5 more in 1875, and during the same year 10 acres were planted in Teak. A small nursery was also formed. In 1885, Sir D. Morris, at that time Director, proposed that the land round the nursery should be made into a public park at a cost of £5,000, though he thought a Botanic Garden could not be carried on without a system of reservoirs for the storage of water. However, Governor Sir Henry Norman decided that, as there were no conveniences at that time for people travelling cheaply from Kingston, there should be no outlay except gradually in forming a Garden.

In 1897 the Government transferred the present Director with Office and Herbarium from Cinchona to Hope, with the intention of making it the central botanical establishment of the island. Since that time the Garden has gradually been formed and extended.*

The following plants are grown for experimental purposes, and also for use in teaching agricultural principles, and the best methods of dealing with these tropical crops :—Sugar Cane, Cocoa, Coffee, Tobacco, Banana, Rubber, Nutmeg, Citrus, Grape Vine, Pine Apple, Cassava, Sweet Potatoes, &c.

Practical instruction is given in the Garden to apprentices, to boys from the Industrial School, to Students at Training Colleges, to Elementary School Teachers in their vacation, to Agricultural Students, and to Planters themselves.

There are about 8 acres under Sugar Cane of several varieties which are being tested by the Agricultural Chemist and distributed to Planters. Seedlings are grown from seed and are tested as they mature.

Forastero and Criollo Cocoa are grown, and experiments are being made as to the effect of shade trees, and as to the difference in growth, and yield of crop, when planted close and at wider distances apart.

Coffee of several kinds may be seen :—Arabian or common Coffee, Liberian, Abbeokuta, Highland Coffee of Sierra Leone (*stenophylla*), Maragogipe, Golden Drop, &c.

Tobacco is under cultivation, and the leaf is cured in the tobacco house close by. The apprentices are instructed in all the details of cultivation, and the technique of curing the leaf for cigar tobacco. A quarter of an acre of Sumatra seed tobacco is grown under the shade of cheese cloth. This tobacco yields a very high-class leaf for the outside wrapper of cigars.

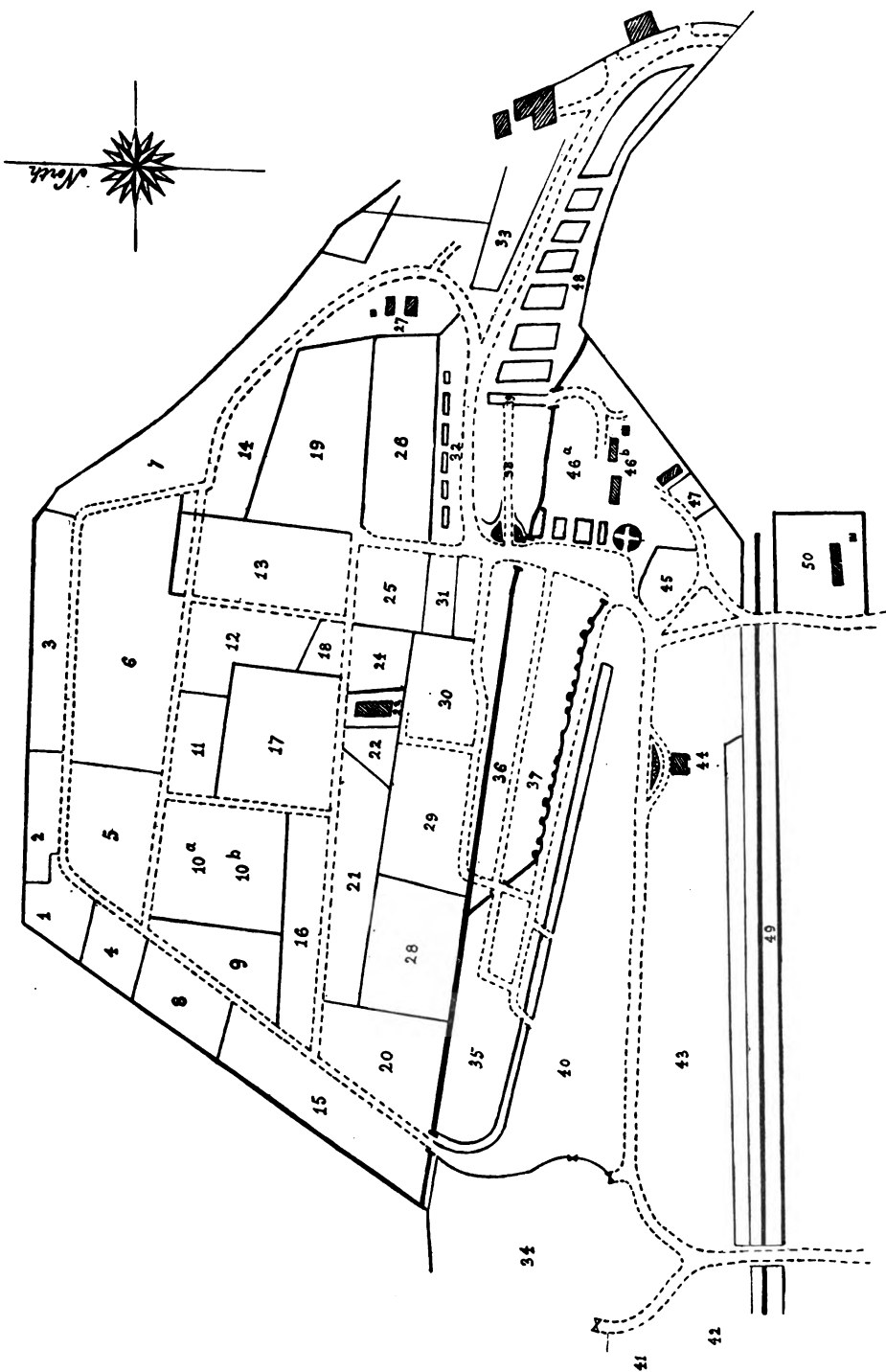
A collection has been established of twenty-three varieties of Banana from various parts of the world, chiefly obtained through the kindness of the Director of Kew Gardens and the Commissioner of the Imperial Department of Agriculture.

Budded Citrus plants have been planted out for comparison, both of varieties that have proved successful in Florida and California, and also of native seedling trees. Attempts are being made to get a variety of Orange which will bear fruit when the highest prices are obtained in English and American markets.

Pine Apples of several varieties are grown, and experiments are being made in cross-fertilising different varieties, with the object, for instance, of getting a pine with the flavour of the Ripley, the fine appearance of the Smooth Cayenne, and the good carrying qualities of the Red Spanish.

Rubber plants of various kinds are grown :—Para, Castilloa, Ceara, Lagos silk rubber, Landolphia, &c.

* See Guide to Hope Gardens by Walter Jekyll. Published by Messrs. Aston Gardner & Co., Kingston. Price, One Shilling.



There are 28 varieties of Cassava collected from different parts of Jamaica, 10 from Porto Rico, and 30 from Colombia. These 68 varieties are being tested as to weight of tubers per acre, and percentage of starch. The starch is said to be better for laundries and for dressing Manchester goods than that produced by any other plant. It is claimed also that Cassava yields more starch per acre than any other plant.

Similar tests, besides value as food, are also carried out with reference to Sweet Potatoes,—27 varieties from Jamaica, 12 from Barbados, and 9 from the U. S. Dept. of Agriculture, Washington, D. C.

Results of tests of plants are published from time to time in the Bulletin and Annual Reports.

A plan of the cultivated portions of the Government grounds is given, so that visitors may readily find any particular kind of economic plant grown there for experimental or teaching purposes.

The following is an Index to the numbers on the plan :—

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GRAPE FRUIT AND SHADDOCKS.

The following popular notes on varieties of grape fruit and shaddocks, by Sir Daniel Morris, K.C.M.G., D.Sc., D.C.L., appeared in *Garden and Forest*, an American horticultural journal published at New York, April 22, 1896. Recently applications for information in regard to the respective merits of grape fruits and shaddocks were received from the Board of Agriculture in the Bahamas and other sources, and with the view of placing the facts on record in an accessible form, they were reprinted in the pages of the *West Indian Bulletin** and are now reproduced here :—

During my recent visit to New York I was much interested to notice the considerable demand that existed there for grape fruit,† from the West Indies. It appears to be very strongly recommended by the medical faculty for its refreshing and tonic properties, and, in consequence, the use of it has become an important feature in the diet in American cities. The fruit I saw in New York called grape fruit consisted of various sorts and qualities, and there is little doubt that much confusion exists as to what is really grape fruit as distinct from the allied citrus fruits passing under such names as Pumelow‡, Shaddock, Forbidden fruit, Paradise fruit and others. The chief characteristics of all these fruits, distinguishing them from the different varieties of the orange, are associated with the size and colour. They are all, or nearly all, larger than the largest orange, and they are uniformly of a pale-yellow colour. In texture the rind may be smooth or even polished. It is seldom rough, nearly always firm and not very thick. The pulp is pale yellow or greenish-white, sometimes pink or crimson. The vesicles of the pulp (juice bags) are more distinct than in the orange; very juicy, somewhat sweetish with a distinct, but agreeable, bitter flavour. The pith surrounding the segments possesses more of the bitter than the pulp, but is less agreeable, and on that account is never eaten. In shape these fruits vary a good deal. Some are quite globular, others somewhat flattened at the top and tapering below, forming a pear-shaped body. Even in the globular fruits the top is more or less flattened. There are none, I believe, pointed at both ends.

Having indicated the general characters of this class of citrus fruits, I may venture on a brief sketch of their origin and history. It is agreed by all authorities that these fruits are quite distinct from the other groups of the orange family, such as the true oranges and the citrons. They have, therefore, been kept apart and ranged under the Giant Citrus, *Citrus decumana*. In this species the tree is 12 to 18 feet high, with a flat crown and spreading branches, usually with no spines. The leaves are elliptic-rounded at both ends, emarginate (that is, with a notch at the apex) and crenulate (having the edge marked with small depressions);

* From West Indian Bulletin, VI., 1905, page 284.

† It is so called because the fruits grow in clusters like a bunch of grapes.

‡ It is invariably spelled Pomelo in the United States.

the under side of the leaf is softly hairy, with the wings broad, crenulated as in the leaves, and bordered with fine hairs. The flowers are in clusters of from three to nine, large, white, and fragrant. The fruit is either globose or pear-shaped, forming many seedling varieties without distinct names. This is supposed to be a native of the islands of the Pacific, whence it had been brought to southern China, Japan, and India. It was introduced to the West Indies, according to Macfayden, from China by Captain Shaddock, whose name has since been given to it. The term shaddock may be correctly applied to any of the larger members of the giant citrus, and is equivalent to the French pomпельmouse, which is another form of the Dutch pomplemoes. The word pomelaw, so widely used in India and Ceylon, is supposed to be a contraction of 'pomum melo,' the melon apple. The largest 'pumelows' in India are said to reach '2 feet in circumference and weigh 10 to 20 lb.' The best sort, according to Bonavia, is 'the thin-skinned, red pumelow of the Bombay market.' This is of a globose shape, juicy, and 'of the colour of raw beef internally.' There are, however, numerous grades in size, some being almost as small as oranges. In India the varieties do not appear to have recognised names. Elsewhere the smaller fruits have been variously called Paradise apples, Forbidden fruit, and Grape fruit.

As regards the proper classification of the West Indian varieties, I cannot do better than record that put forth by Dr. James Macfayden, the learned author of the *Flora of Jamaica*, which, however, he never lived to carry into more than one volume and part of another. Referring to the large-fruited sorts, he states: 'There are two varieties of shaddock. In the variety *a. maliformis*, the fruit is globose, with the pulp of a pale-pink colour, approaching to a very light yellow. In the variety *b. pyriformis* the fruit is more or less pear-shaped, and the pulp is of crimson colour, more or less intense. The second of these varieties is the more esteemed, being sweet and juicy and having only in a slight and palatable degree the acidity which abounds in the first. . . I may remark that I have always found the pear-shaped variety good, whereas it is seldom the case with the round-shaped fruit. There cannot be a doubt but that, if budding, as is done in China, were more generally practised, instead of trusting to propagation by seed, the fruit would be much improved.'

The smaller pumelows or shaddocks are ranged by Macfayden under a distinct species, which he calls *Citrus paradisi*. The tree is described as 30 feet high, of handsome appearance, with sub-erect branches and sharp at the apex. The leaves are oval, rounded, and smooth on both sides. The flowers have linear petals and the stamens are twenty-five in number. The differences between this and *C. decumana* appear to consist in the more erect habit of the plant, in the rounded (not emarginate) leaves, and in the linear-rounded (not oblong-obtuse) petals. With regard to the fruit he remarks: 'There are also two varieties of this species: var. *a. pyriformis*, Barbados Grape fruit; var. *b. maliformis*, For-

bidden fruit. The pear-shaped variety, as the shaddock, possesses most of the sweet principle, and is, on the whole a preferable fruit.' This classification was made by Macfayden nearly sixty years ago, therefore long before these fruits were so widely distributed as now in other parts of tropical America. He was so accurate and skilful an observer that, as far as the new world fruits are concerned, we cannot very well improve upon it. It is doubtful whether the small-fruited sorts he places under *C. paradisi* really deserve specific rank, but that point does not affect the main question with which we started, namely—what are the differences, if any, existing between the shaddock and the grape fruit? In summing up the results of the investigation, we may say that all the larger-fruited sorts may be called indifferently either pumelows or shaddocks. These are merely the eastern and western names for the same thing, and are perfectly interchangeable. No distinction appears ever to have been made between them. There are two well-marked varieties, one being globose, with the flesh of a pale-pink colour, and the other pear-shaped, usually with a deep-pink or crimson pulp. As regards the small fruited sorts, these, according to Macfayden may be either globose, when they are called forbidden fruit, or pear-shaped, when grape fruit is the older name. The name forbidden fruit (from a fancied connexion with the Garden of Eden) is tolerably old in the West Indies. Tussac, in the *Flores des Antilles*, published in 1824, gives a good figure of the typical shaddock, which he translates into the French *Chadec*. In Vol. III, pp. 73–74, he states: 'J'ai eu occasion d'observer a la Jamaïque, dans le jardin botanique d'East, une espèce de Chadec dont les fruits, qui n'excedent pas en grosseur une belle orange sont disposés en grappes: les Anglais de la Jamaïque donnent à ce fruit le nom de "Forbidden-fruit," fruit défendu, ou smaller shaddock.' Later on he refers to the same fruit in the following words: 'C'est une assiette de dessert très distinguée et fort saine' (p. 74). In the case of the forbidden fruit and grape fruit they are exactly reversed. As usually happens, when a name has become familiar in commerce, it is eventually applied in a much wider sense than the original one. Thus, the term grape fruit has become so general that any moderately large fruit provided the skin is pale-yellow, thin and smooth, and the pulp of a delicate flavour, is designated by it. The fruit commonly called grape-fruit in New York is really the forbidden fruit of the West Indies. The true grape fruit is pear-shaped, and according to Macfayden, when obtainable at its best, is preferable to the forbidden fruit. The fruit shipped from the Bahamas as grape fruit is usually round with a polished yellow skin of a silky texture and very heavy. This is probably one of the best of its class, and quite equal to Macfadyen's pear-shaped variety. Next comes some excellent fruit from Jamaica, no doubt that already referred to by Tussac under the name of forbidden fruit, a smaller shaddock. According to the New York estimation, this would be almost a typical grape fruit, supplying 'une assiette de dessert très distinguée et fort saine.'

Further information on the pumelow was contributed by Sir Daniel Morris to the *Gardeners' Chronicle*, 1896, Vol. II., p. 616, as follows :—

I have been asked more than once lately whether there is no fruit, yet unknown to most English palates, which might be introduced into this country, and form a pleasant article of food. As there seems to be some general interest in the subject, your readers may, perhaps, like to hear of some fruits which have come under my notice.

The pumelow of India, one of the giant members of the orange tribe, is well known to people who have lived in the East. Some very large specimens have been known to attain a circumference of more than two feet, and to weigh from 15 to 20 lbs. Generally pumelows are not held in high esteem in India and Ceylon, except by those who have lived long there, and know how to select the best sort by their size and colour. The best Bombay pumelows are said to be exceptionally good. They have a pink pulp of a juicy character, sweet in flavour, with a slight but agreeable bitter taste. The first pumelows were brought to the West Indies by Captain Shaddock about 150 years ago. Since that time the fruit has always been known in that part of the world as the shaddock, in compliment to the person who introduced it. Owing to circumstances of soil and climate, and to the raising of plants almost exclusively by seed, many varieties have sprung up that have become recognized by distinct names. Of the larger fruits, the pumelow or shaddock proper, there are two well marked forms; the first is the apple-shaped shaddock, usually with a whitish or a pale pink pulp, the other is a pear-shaped fruit, with a pink, and sometimes a deep crimson pulp. Both these are large fruits, weighing from 3 to 6 lbs. in weight; they have the characteristic pale yellow skin, and inside there is a white pithy layer more or less thick; then comes the pulp with the vesicles or juice bags very prominent—indeed the latter are so distinct that they can be easily separated the one from the other. The bitter flavour is very marked in the inferior sorts, in some instances it becomes quite acid. The best sorts have a sweetish flavour and only a slight taste of bitter, of the smaller fruits, to which Macfadyen has given the name of Paradise fruits, there are in the West Indies two well marked forms. The apple shaped fruits are known as forbidden fruit, while the pear shaped sorts are known as Barbados grape fruit. Both these are very attractive looking fruits; they have a pale yellow skin usually very thin, are soft and silky to the touch, while the pulp is sweet and refreshing. The slightly bitter flavour is regarded as giving them tonic properties of great value in dyspepsia and allied ailments.

During the last fifteen years the paradise fruits, or more correctly grape fruit, have been in great demand in the United States. They have been very strongly recommended by the medical faculty, and in consequence their use has become an important feature in the diet of a large number of the American people.

The consumption of them has increased by leaps and bounds, and every year for the past few years it has more than doubled. A few days ago (says *Garden and Forest*) 2 barrels of small-sized grape fruit realized the extraordinary price of £5 each in New York; and 7 barrels of similar fruit were sold in Philadelphia for £5 10s. each. Such fruit would retail at more than \$1.00 a piece. This is probably the highest price ever paid for specimens of the orange tribe. It shows very clearly how keen is the demand for grape fruit, and what importance is attached to it as a refreshing and healthful adjunct to the food supply of the United States. At one time there was a better market for grape fruit—or, rather forbidden fruit, as it was called—in the United Kingdom than in America, but the tables are now turned. America especially since the destructive frosts in Florida, has now absorbed almost the whole supply from the West Indies. Sooner or later, however, English people will realise the special merits of the grape fruit and a demand will arise for it, to the possible advantage of those West India Islands which are in a position to supply it. It would be well, therefore, for the people in that part of the world to establish small orchards of grape fruit trees of the best quality, and to be prepared to ship the fruit in such condition that they may get the best price for it. This would be one way of alleviating, to some extent, the depression under which they are now suffering, owing to the unremunerative character of the sugar industry.

The following, containing further notes on grape fruits and shaddocks, was contributed by Sir Daniel Morris to *Chambers' Journal* of January 30, 1897.

Under the title of 'paradise fruits,' Dr. Macfadyen, many years ago, described some interesting members of the orange family. Their origin was not clearly traced, but there was little doubt that they had been produced by seed variation in the West Indies. Their nearest relations were the common shaddocks or pumelows (*Citrus decumana*). These are well known as the largest of the citrus fruits; some fine specimens have weighed as much as 20lbs., and measured 2 feet in circumference. According to Alphonse de Candolle, 'shaddocks and pumelows are probably natives of the islands east of the Malay Archipelago.' They were found in a wild state by Seemann and others in the Fiji Islands and the Friendly Islands, so there is little doubt of their Polynesian origin. They are now distributed in most tropical countries, but, except in a few localities, they are not so highly esteemed, for instance, as the best oranges. Usually the skin is thick and pithy, and the pulp bitter, and there is little or no demand for them in commerce. The paradise fruits, on the other hand, are in great demand, and they are regarded as the most refreshing and wholesome of any of the citrus family. Recently in New York, some of the latter were retailed at almost fabulous prices, and the demand increases every year. The paradise fruits, while they fall specifically under *Citrus decumana*, or the giant Citrus, have many points of merit, not the least of which, is the keen preference shown for them by

the people of the United States. They are quite distinct from the true oranges, citrons, and other groups of the orange family.

The typical fruits of *Citrus decumana* are those known in India as pumelows (a contraction of *pomum melo*, the melon apple) called by the French Pompermouse or Pamplemouse, and by the Spanish and Dutch Pompermooos. As these fruits were first introduced to the West Indies by Captain Shaddock, in that part of the world they have always borne his name. Pumelows and shaddocks are only the old and new world names for the same fruit. Sometimes it is stated that the largest fruits are called shaddocks and the next in size pumelows. There is no authority for this distinction. In this place, I shall quote pumelows and shaddocks indifferently as convenient popular names for all the largest fruits of the typical *Citrus decumana*. A preference may unconsciously be given to the use of the word shaddock, but only because it is the most familiar name in the West Indies. As regards the varieties of these fruits existing in different parts of the world, they are for the most part distinguished by the locality where they are grown rather than by any character they may possess. For instance, in India the best pumelow, according to Bonavia, is the thin-skinned, red pumelow of Bombay. This is a perfectly globose fruit, very juicy, and with the pulp of a rosy-red colour. The botanical characters of *Citrus decumana* are perhaps more marked than in any other species. The tree is larger, and both the young shoots and under side of the leaves are covered more or less with soft down. No other species of citrus has the latter characteristic. The tree may be as high as 20 feet, with a flat crown and many spreading branches. Usually there are no spines. The leaves are distinctly rounded at both ends, with a notch at the apex; the edges are uneven or wavy, owing to the presence of a number of small depressions; the stalk or petiole is furnished with two broad wings, also wavy, and bordered with fine hairs. The flowers are somewhat like those of the orange, but larger, and are both white and fragrant; they are usually in clusters of three to nine. The fruit is spherical or pear-shaped, very large, sometimes even as large as a man's head, and very heavy. The juice is always slightly acid, while the rind in the common sorts is remarkably thick, with a bitter inner membrane. The vesicles containing the juice are very prominent, and arranged transversely; in the orange they are hardly discernible.

Pumelows or shaddocks differ from other citrus fruits in size; they are invariably larger than the largest orange and, in addition, are compact and very heavy. In colour, they are pale-yellow, almost like lemons, but they differ from the lemon in having usually a smoother skin. The flesh is pale-yellow or greenish-white; in some sorts there is a tendency to pink or crimson, as in the so-called 'blood-oranges.' The pink-fleshed shaddocks, if otherwise acceptable, are more esteemed than the white-fleshed. They are said to be sweeter and more juicy, and have only in a slight and palatable degree the peculiar flavour of the ordinary

shaddocks. Macfayden, sixty years ago, stated that he always found the pear-shaped shaddocks better than the spherical sorts. His experience is not invariably endorsed at the present time. Some of the spherical fruits are of a very delicate flavour, and, as already mentioned, the best of the Indian sorts are not only spherical, but have also a pink flesh.

So far, I have described the fruits of the typical *Citrus decumana* only. When we come to the smaller fruits, we find that both in the tree yielding them, as well as in the fruits themselves, there are certain distinguishing features which show they are rightly separated by Macfadyen, although we cannot go so far as he has done in assigning the plant producing them specific rank. Macfadyen grouped the smaller fruits under *Citrus paradisi*, thus expressing his appreciation of them by designating them the fruits of Paradise. He distinguished two varieties, to which he gave the names of forbidden fruits and the Barbados grape fruit. He described the tree as of handsome appearance, about 30ft. in height, with branches sub-erect and sharp at the apex. It will be noticed that in the shaddock the tree was 20 feet high, with a flat crown and spreading branches. The leaves are oval, rounded, and smooth on both sides. The flowers have linear instead of oblong petals, and the stamens are twenty-five to twenty-six in number instead of thirty to thirty-five. The fruits, as in the shaddocks, are either spherical or pear shaped. To the pear shaped fruits were assigned the name of grape fruit, because they usually grow in clusters; while the spherical fruits were called forbidden fruit from a fancied connexion with the Garden of Eden. This classification was made by Macfadyen nearly sixty years ago therefore long before these fruits were so widely distributed, as now, in various parts of tropical America. The forbidden fruit was known to Tussac in 1824, who called it 'Fruit Défendu, or smaller shaddock.' Later he refers to the same fruit in the following words: 'C'est une assiette de desert très distinguée et fort saine.' With the exception of the shape, forbidden fruits and grape fruits are very much alike, but they are both superior to any shaddock or pumelow—the fruits of *Citrus decumana*—while the smaller and more delicate fruits bear the distinctive name of paradise fruits. Of these the grape fruit is the one now so highly esteemed in the United States. The *Penny Cyclopædia* had adopted a similar classification even in 1837. It is stated: 'When these fruits arrive at their greatest size, they are called pompelloes or pomelmousses; when at the smallest, they form the forbidden fruit of the English markets. Another small variety, with the fruit growing in clusters, is what the West Indians call grape fruit.'

The grape fruit is not a shaddock nor a pumelow. It is quite a distinct fruit, and possesses exceptional merits; at its best, it differs from the shaddock as much as a fine apple from a common crab.

We may be sure that such keen-witted men as the fruit merchants of New York would not give high prices for grape fruit unless it were in great demand and thoroughly appreciated by people able to pay for a choice and delicate article. It is estimated that there were received in the United States last year grape fruit of the value of about £20,000. The demand for it is quite of recent date, but it is increasing so rapidly that in a few years the grape fruit will be one of the most valuable of the citrus fruits in the New World.

There are doubtless, many inferior sorts of grape fruit. In fact in the West Indies the plants have been allowed to run almost wild. No care has been taken to select the best varieties, or to bud and graft them, so as to keep them uniformly at a high standard. *Garden and Forest*, the leading horticultural journal in America, very wisely advises that, wherever the fruit is grown, it should be borne in mind that the highest success will only come with the use of the best varieties. There is no need to grow the thick-skinned and bitter sorts, and those with a dry, cottony pulp, while there are varieties both of the apple-shaped and pear-shaped fruits with a silky skin, full of juice and of a most delightful flavour, with just enough bitter to give it piquancy and suggest its valuable tonic qualities,

Mr. C. B. Hewitt gives the following account of the grape fruit :— At one time it was not thought much of in Florida, being only eaten by the old Floridians as a spring tonic, to drive away malaria. As soon as its great medicinal qualities were recognized, the doctors began to recommend it for indigestion, and also as an appetizer. The majority of people who eat this fruit do not like it at first, and many have not tried to like it, on account of the bitterness of the pithy membrane dividing the pulp. The correct way to eat this interesting fruit is to remove carefully this lining and to eat only the pulp. Some people prefer to cut the fruit open through the middle, take away the seeds, and then sprinkle a little sugar over the cut surface, and work it in with a spoon. Then let it stand for a little time, or overnight and eat before meals.' 'There is nothing,' continues this writer, 'in the fruit line yet discovered that possesses the medicinal qualities of the grape fruit. The demand for it will increase from year to year, and take up all the fruit that will be grown for the next twenty years. As many as 6,000 fruits are said to have been gathered from a single tree. This was an exceptionally fine specimen. It was described as 49 feet in height and 30 feet across its widest branches. It was thirty-four years old.' There are many varieties of grape fruit, some seedless, or with an occasional seed only.

The grape fruit is in such great demand in America chiefly because it has been so highly recommended by the medical faculty for its valuable dietetic and tonic qualities. It is also very refreshing, and is regarded as a specific for dyspepsia. The Americans are large fruit-eaters, and seldom begin or end a meal with-

out fruit of some kind. To supply them with bananas alone, there arrived from the West Indies during the year 1895, 185 cargoes of this fruit, comprising nearly 17,000,000 bunches, of the value of over £5,000,000 sterling. Jamaica furnished the larger share of this immense shipment of tropical fruit; and that island is becoming quite prosperous in spite of the great depression that has overtaken all the sugar-producing countries in that part of the world. Hitherto, Florida has supplied a good deal of the grape fruit for the American market, but since the disastrous effects of the 'freeze' of last year, the Florida plantations have been almost destroyed. Much English capital invested in fruit growing in that state has been lost, and many of our young countrymen settled there have suffered a severe reverse of fortune. Even where the groves are not quite destroyed, it will take years of toil and expenditure to bring them back to their former condition. For some time, at least, the chief supplies of grape fruit must therefore be drawn from the West Indies. The people in that part of the world would do well to establish trees of the best varieties, and take advantage of the opportunity to participate in what promises to be a steady and remunerative industry.

THE BREAD-FRUIT TREE.

Stephen Fuller, the writer of the following letter (one of the last he wrote in his official capacity), was agent for Jamaica in London for no less than thirty years—from 1765 to May 1795, when he was succeeded by Robert Sewell.

He belonged to a well-known Jamaica family founded by Colonel Thomas Fuller, a soldier of fortune, who, coming out under Venables in 1655, became a member of the Council. Other members of the family sat in the House of Assembly during the eighteenth century.

The Council and the Assembly at that period considered it desirable that, their agent should have a seat in the House of Commons, and when Sewell succeeded Fuller they raised the salary from £500 to £1,000 with that end in view.

Fuller represented Jamaica in the House of Commons during the early part of the struggle which led to the abolition of the Slave Trade, and was an out and out supporter of the planters' views, publishing various Reports on the subject by direction of the Assembly.

The bread-fruit trees referred to had been brought to Jamaica, from Otaheite, by Admiral Bligh, in 1791; for which Bligh received a vote of one thousand guineas from the House of Assembly of Jamaica, and the gold medal of the Society of Arts of London. The letter appears in the manuscript letter-book of the Agent of Jamaica for 1794-1801, in the Library of the Institute of Jamaica.

F. C.

London, 31st March, 1795.

HONBLE. GENTLEMEN :

It is with singular pleasure I have heard that there are many of the breadfruit trees, now in fruit, and many more in blossom in our island. As we owe the blessing of this introduction entirely to the King, I am sure you will think as I do that he has a peculiar right to the primitives, the fruits first produced from those trees. I know nothing that would give his Majesty greater pleasure, and if it was accompanied with a proper compliment from the Legislative body, it would make the present still more acceptable.

The manner I would wish it to be sent in, if you think proper, is this, to send ten or twelve in number of the fruit, in a large jarr, covered with strong rum, well corked, bound with leather and pitch and resin melted upon the cork. And I would wish it to be directed to the Chairman of the Custom House, with a letter to him by the same ship (tho' I will signify to him that he may expect such a present), setting forth the reason of sending it to him, in order that it may not be overhauled by the searchers, who will be sure to do it some injury or other: and if you will give orders for it to be delivered to me, I will take care to get a capital flint glass vase for it, properly inscribed and to put some proof spirits instead of the rum and present it myself. His Majesty knows me, and has been pleased to express great satisfaction at the method I took two or three years ago to enrich his garden at Kew with a great number of Jamaica plants more than had been introduced there in twenty years before. I will consult Sir Joseph Banks upon it, and we will endeavour to make it an agreeable present, equally honourable to the maker and the receiver. I have been many years in pursuit of this object, even since Captain Cooke's returned from his first voyage to Otaheite; old Beeston Long and myself being the two first persons that subscribed our names to a paper drawn by myself promising a reward to the first person that should bring the Breadfruit tree to the Island of Jamaica; but all our endeavours proved abortive, till His Majesty most nobly undertook it, strenuously persevered in it after one failure, and at last accomplished it. His Majesty is a true friend to the colonies. I am of opinion we owe more to him than is generally known in regard to the defeat of the absurd attempt of abolishing the slave trade, which I think we shall hear no more of, even in the H. of Commons after the next general election. Till then, you will. I hope to live to see a considerable increase of negroes in our Island, and every one of them with two or three breadfruit trees in his own garden. They will then see who are their friends.

I have the honour to be, Honble. Gentlemen,
Your most obliged and obedient servant,

STEPHEN FULLER.

The Honble.

The Committee of Correspondence.

BOARD OF AGRICULTURE.

The usual monthly meeting of the Board of Agriculture was held at Headquarter House, on Tuesday, 16th January, 1906, at 11.15 a.m. Present :—Hon. H. Clarence Bourne, Colonial Secretary, Chairman ; the Director of Public Gardens, the Superintending Inspector of Schools, the Island Chemist, His Grace the Archbishop, Messrs. C. E. deMercado, J. W. Middleton, G. D. Murray and the Secretary.

The Secretary submitted the following letters from the Colonial Secretary's Office :—

1. *Contagious Diseases Animals Bill*.—Re Contagious Diseases Animals Bill, stating that it was not proposed to introduce the proposed bill at the next session of the Legislative Council.

The Secretary read a minute saying that when he was attending a meeting of the local Agricultural Society at Appleton, one small penkeeper said that he had lost 10 cows and one bull in two weeks and that the carcasses had been allowed to lie and rot. He suggested that a description of a few of the most contagious diseases among animals might be published throughout the island, that it might be made compulsory to report to the police the outbreak of any such diseases and the burning of carcasses ought also to be made compulsory.

(The Chairman here left the meeting to attend a meeting of the Privy Council and the Director of Public Gardens was asked to take the Chair.)

After discussion Mr. Middleton moved that members of the Board should meet members of the Board of Management of the Agricultural Society at the latter's meeting the next day and discuss the whole matter of legislation regarding contagious diseases among animals so as to get something practical settled as soon as possible.

This was agreed to.

2. *Coco-nut Disease*.—Letter from Mr. G. P. Dewar, Harmony Hall, Duncans, asking if the Government could not introduce some law to make it compulsory for the owners of diseased coco-nut trees to cut them down and burn them, as the disease was prevalent in Hanover where he was in charge of a valuable property, and seemed to be gradually spreading without anything being done to prevent it.

The Secretary was instructed to reply first that the matter had been referred to the Director of Public Gardens, who had replied that the same bud-rot disease had been dealt with in the Bulletin, in which was stated the result of experiments laid down by him and carried out by Mr. Cradwick, that the disease could be prevented by spraying with Bordeaux mixture ; and secondly that the Board would arrange for Mr. Cradwick to give a demonstration at Lucea. On the suggestion of the Archbishop it was resolved

that the Director of Public Gardens should publish a leaflet embodying what was known concerning this disease.

3. *Sweetstuff Factory*.—Letter from Mr. Edward Redsue, British Colombia, suggesting that a big sweetstuff factory should be started in Jamaica for the production of Jamaica Rum Lime Tablets and other Rum flavoured Sweetmeats.

The Secretary was instructed to ask the authority of the Governor to have this letter published in the newspapers for the information of all whom it might concern.

4. *Jamaica Scholarship*.—Letter from Schools Commission *re* Jamaica Scholarship. Mr. Cousins' memo *re* proposed alteration in Jamaica Scholarship with criticisms of the Superintending Inspector of Schools and the Archbishop were also read.

After discussion the Archbishop moved that—

“In the opinion of the Board of Agriculture it is undesirable to allocate the Jamaica Scholarship every third year for agriculture, that a more efficient stimulus of general agricultural education might be effected on the following lines as indicated more fully in the correspondence, each of the Scholarships to be available annually :—

1. The restriction of the Jamaica Scholarship to as low a point as is consistent with making it really available for the purposes of various classes of students.

2. The appropriation of the remainder of the available money for an Agricultural Scholarship tenable for two or three years at an Agricultural College abroad to be awarded upon the Diploma Examination of the Board of Agriculture.” This was unanimously agreed to.

School Chart.—His Grace the Archbishop brought forward a matter which had been discussed at the Board before and which had been in hand for nearly two years. This was a list of “Agricultural Dont's” prepared by Mr. E. J. Wortley in conjunction with Messrs. Hicks and MacFarlane, to form a chart to be hung up in schools and be repeated over twice a week by scholars. The Secretary was instructed to get copies of this typed and sent to each member of the Board who were asked to make any suggestions.

Mr. S. Olivier.—A letter of acknowledgement from Mr. Sydney Olivier *re* the Locked Still matter was directed to be circulated.

Cotton.—A letter from Mr. G. Musgrove, Jackson, Mississippi, in reply to the Secretary's letter sending him a sample of cotton was submitted and directed to be circulated.

Reports.—The following reports from the Chemist were submitted :

1. Agricultural Scholarships Examination.
2. Report work of Agricultural Students for Michaelmas Term.
3. Report on Banana Soils of St. Mary.
4. Progress Report Distillers Experiments.

5. Appointment of two assistants, Sugar Department.

These were directed to be circulated.

The Director of Public Gardens submitted Reports as follows :—

1. Experiment Station.

2. Instructors.

3. Letter from India re varieties of bananas.

These were directed to be circulated.

The following papers which had been circulated, but not yet submitted to the Board, were submitted :—

1. Memo re proposed alteration in Jamaica Scholarship.

2. Report of Committee appointed to investigate the Cotton Caterpillar Pest in Jamaica. It was resolved to publish this report in the form of a special 'Bulletin.'

3. Publications on 'Bud-rot Disease of Coco-nut Palms' and forwarding diseased plants and insect pests, both sent by the Imperial Department of Agriculture, Barbados.

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Part 3.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.,

Director of Public Gardens and Plantations.

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P R I C E—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send name and address to the Director of Public Gardens and Plantations, Kingston P.O.

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Part 3.

CULTIVATION AND MARKETING OF CITRUS FRUITS.

BY H. Q. LEVY.

An Address delivered at the Annual Meeting of Elementary School Teachers for Agricultural Instruction, January, 1906.

The subject set down against my name on the Syllabus, is "The Cultivation and Marketing of Citrus Fruits." Some may well ask why it is that I persistently advocate the cultivation of Citrus fruit year after year when we cannot dispose of those we already have growing wild about the different parts of the Island. My answer would be, as I have often repeated, because by cultivating standard varieties we would have a ready-made market for all the fruit we could grow; secondly, we would have a more even grade of fruit that would better stand shipment, and thirdly, by having the trees in grove form we could handle them quicker and more carefully than by the present system. I advise, time and again, the planting of the improved varieties of oranges and grape fruit as I firmly believe that there will always be a market for them if shipped in a proper manner and given every chance of their arriving at their destination in a good condition; on the other hand, I have always said that at no distant day we will have no sale for our wild oranges except when the foreign markets are bare of supplies. Now this is a subject well worth considering, for it means bread and butter to many of us. Are we going to waste time until we are elbowed out of the market altogether? or are we going to set about planting improved varieties and so gradually capture a portion of the market that is ready waiting for us? Do not be discouraged by the number of failures that have taken place in the past, for if you enquire into each one you will be sure to find that in every case the parties were doomed to failure from the very commencement. Citrus culture needs careful study and a special

knowledge of the requirements of the tree to ensure its success, so that at the outset when men who knew nothing of the cultivation or principles to be followed, launched out by planting 30 or 40 acres of oranges and grape fruit, were simply tempting Providence.

Now it is not my intention or desire that any of you should go away from this Lecture Hall believing that by taking up citrus culture you are going to make your immediate fortunes, or that even if you follow my instructions implicitly there will be no failure; these things I cannot promise, but this I will say, that it is my firm belief that all those who embark in citrus culture on a small scale at first, and follow out my instructions will in the years to come find they have in their small groves quite as profitable an investment as any other product they may grow, and one that is especially suited to the man of small means.

For all practical purposes, in dealing with citrus plants this afternoon, although there are endless varieties, we need only take into consideration for commercial purpose, two of the species, the "Sweet Orange" and the Pomelo, or as we call it in Jamaica, "Grape Fruit," and as the cultivation and treatment of both are similar, I will treat them under one head, which will both save time and prevent any undue confusion in your minds.

In the first place I would particularly warn you against the great mistake most people have made in starting on too large a scale, a quarter of an acre you will find will be quite large enough an area for a start, extending your cultivation as you gain experience and your means allow. A universal mistake that nine-tenths of the men in Jamaica make, whether in Commerce or Agriculture, is, taking on more than they can manage. Always bear this in mind, that whereas the right amount of money spent on just sufficient cultivation, may bring you in a handsome profit, the same amount spent on twice the acreage or undertaking, is sure to land you in serious losses and make you disgusted with that special industry.

In starting a citrus grove the first thing to be considered is suitable land, and this is a great point if you desire to meet with success. In every case a gentle slope will be found to give much better results than very level land, heavy clays should be avoided, a soil of limestone formation such as the red soils of St. Ann and Manchester, do admirably for oranges and grape fruit, and you might say constitute the natural home of the orange in Jamaica. The ideal location for a grove will be found on soils that are interspersed with limestone rock, but yet having plenty of deep soil around them; it will not be so easy to cultivate but will be found in the long run to give better results. A rich sandy loam is also good, but you will find that this description of soil, being found nearer the sea coast, is accompanied by a very dry and hot atmosphere, the fruit takes longer to mature and the colour will not be so good when it ripens.

Having chosen the spot for your grove you must set about propagating plants to stock it. For this purpose I would advise your

starting a small nursery, as it is better to grow your own plants than purchase them from other parties, it will be found cheaper, more interesting, and when the planting time arrives, you may cull out all the bad ones, only planting those with good fibrous roots and well-developed stocks.

I will not go into the method of forming a nursery, as I understand that is part of the course which you are now undergoing in the section of field work. But I must tell you this, under any circumstances use only grape fruit stock for budding on, and at all times use budded trees in preference to seedlings for your groves, and you are sure to get the same quality and kind of fruit as the description from which you took your bud-wood. But if you grow seedlings and allow them to become permanent trees you are sure to get the majority of them bearing very indifferent fruit, and of uncertain shipping qualities. Grape fruit is an exception to this rule, so long as you procure your seeds from trees that are far removed from any other variety of citrus plants, but even then the fruits from which you take the seeds, although looking fine and a desirable sort, may have been hybridized by some inferior one in that particular section.

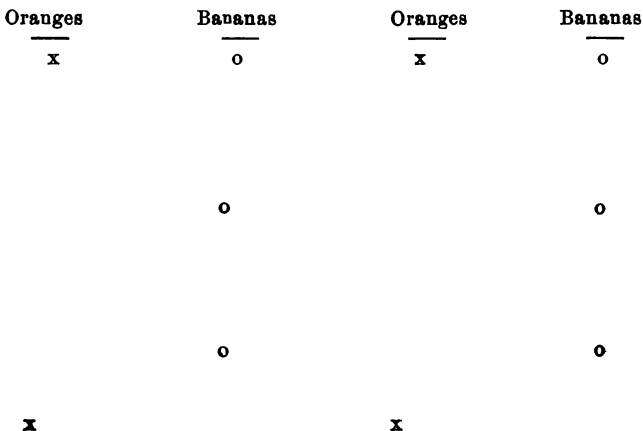
Having started your nursery, the plants doing well, and near ready to be transplanted, that is, when they have reached a height of about two or three feet, it is best to turn your attention to the land chosen for your grove. It should be cleaned and lined out,—for oranges 20–25 feet apart, and for grape fruit 25–30 feet, the rows running parallel and square to each other; at each stake dig a hole 2 feet in diameter and about the same depth, say one month before planting; leave it open until just the day before so that the sun may get a fair play on the soil in the bottom of the hole. In filling in a hole put the top soil at the bottom and fill in with the surrounding top soil scraped from around the hole, using the earth from the bottom of the hole to replace any such soil taken away from the adjacent land. The tree should be planted on a hill somewhat resembling that used for planting yams but not quite so high and somewhat more rounded over the top, this will enable your plant to be placed about 6 inches higher than the surrounding soil. In taking up the plants from the nursery be careful to preserve every small root, do not take up more than you can plant immediately and never expose, even for a moment, the roots to the direct rays of the sun or to high winds; the ends of the longer roots should be cut back a few inches, also the tap root, the head of the plant must have its share of trimming and all the leaves cut away three-quarter of their area, as by so doing you equalize to a certain extent the shock to the plant that you have caused by disturbing the roots. Arriving with your plant at the side of the hill, use your hand to make a hole in the centre of it, large enough to take in all the roots when laid out in their original position: stand the plant upright, then put in some earth and firm it well around the tap root, leaving no air spaces, as this would be sure

to cause the death of the plant or stunt its growth: pour in some water and put in more earth, firming it again, continue putting earth and water alternately until the soil is level with the highest root; that highest root should now be about 6 inches higher than the surrounding soil. As the earth settles, so will the tree, until it takes up a permanent position with the top root just exposed to the air. Citrus plants should never be planted deep, better to have them six inches too high than half an inch too deep; defective planting has been the cause of more failures than all others put together, as by planting too deep you will find it make no growth and be a fitting subject to all the diseases to which the citrus family is subject, and these are many, especially when planted under unfavourable conditions. It will be well to spread some dry grass or trash of any kind all over the hill until you are certain that the trees have taken root, say in about four weeks, as by so doing you conserve the moisture in the soil; if no rain, you must water at least once a week until the first growth after planting has fairly ripened, this stage is reached when the new leaves turn to a dark green.

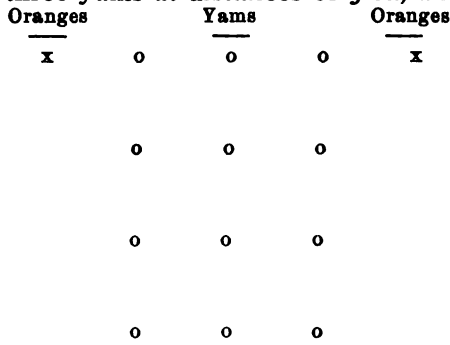
As it would be very expensive to keep the land clean for a number of years where only citrus plants are cultivated it is advisable to establish catch crops which would give some revenue and at the same time not injure the trees in your grove. Fortunately there are many such crops that may be grown without detriment, such as bananas, cocoas, yams, cassava, corn or peas. Try to avoid planting sweet potatoes in any citrus grove, except you plant only two rows down the centres and keep the vines from spreading too near to the trees, the same applies to pumpkins.

I will now demonstrate to you the distances apart it would be best to plant the plants I have named so as to give you a maximum yield and a minimum amount of damage to your citrus cultivation.

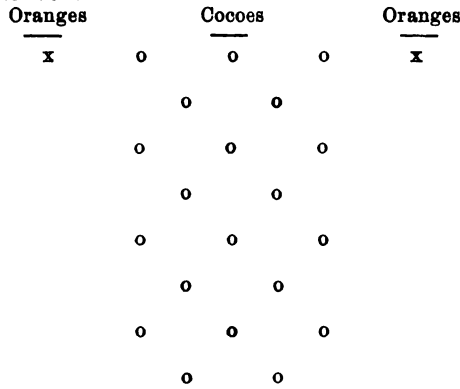
(I) Banana as catch crop until orange trees are 2 or 3 years old, orange trees 20 ft. apart, bananas in the middle of the rows at a distance of 8 ft. from one another :—



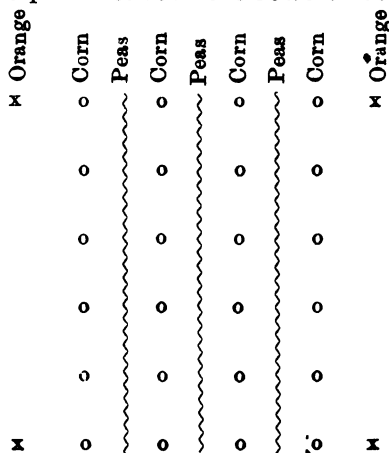
(2) Yams put in between the oranges at distances of 5 ft. then another row of three yams at distances of 5 ft., and so on :—



(3) Coccoes put in like the yams, but one also in the middle of each square, and so on :—



(4) Corn and peas : the corn should be put in at distances of 4 feet apart, and the peas between the rows of corn :—



Always keep your land clean and as soon as your trees start to bear, remove all catch crops from the land except peas which you may continue to grow for some time as this being a nitrogeaneous crop rather adds to the fertility of the soil than otherwise.

I should not pass this stage without giving you some advice as to the varieties of oranges and grape fruit to plant. In the citrus family we have a large number of species, and these are again divided up into endless varieties. For instance take the sweet orange. Of the cultivated varieties we have under the class called Navel :— Petersfield, Washington, Australian, Thomson's Improved, &c., and under ordinary or seeded varieties, St. Michael, Valencia, Ruby, Homosassa, Parson Brown, Majorca, Jaffa, Pineapple, Tardif, Rivers, Blood, &c., and a host of others too numerous to mention ; then it is almost the same with grape fruit ; the imported varieties include the following :—Marsh seedless, Triumph, Pernambuco, Royal, Walters, Duncan, &c., and in Jamaica there are almost as many varieties as there are trees in the island. But for our purpose we can bring the oranges down to two or three varieties that are worth while cultivating. I would advise your propagating in preference to all others the Petersfield Navel as being the most vigorous grower and heaviest cropper of them all ; the Washington and Thomson's Improved Navel are also very good ; all Navels are classed as seedless varieties. Of the seeded sorts you cannot get a better than the Pineapple, for although it contains a very large number of seeds it is a very strong grower and cropper, and is seldom attacked by disease of any kind, and having a very tough skin, is one of the best shippers I know of. Of grape fruit I should advise your planting some selected Jamaica variety as the foreign sorts are not to be compared with them either for flavour or texture. I have tried all the oranges and grape fruit quoted, therefore I speak from actual experience.

The citrus tree requires very little pruning except in the time of its first growth after planting when all suckers below a height of two feet from the ground should be removed with a sharp knife and covered with some paint, after that just prune up the limbs that have a tendency to droop towards the ground, and any dry branches ; more than this would not be necessary.

With manuring we have to be very careful, as the citrus are very particular. Stable manure of any kind should never be used except very old and well rotted, the same applies to that obtained from the pig. Sheep manure is different, it can be used at once. Ashes are good at all times. Remember all manures must be applied in advance of the roots so that it may be thoroughly incorporated with the soil before the roots reach it, in which case it will be of benefit to the tree, otherwise applied it will bring on endless diseases of the root.

This brings us to the stage when I must say something as to the diseases of the citrus. All are more or less caused from bad managment, such as planting too deep first and foremost, the appli-

cation directly to the roots of rank manures, bad cultivation, and a disease that I call "Greedy Choke Puppy" i.e., planting catch crops right up to the trees, allowing pumpkin and bean vines to grow all over them.

I will first deal with a disease known as "Foot Rot." It is first observed by a yellowish gum exuding from the roots or the trunk adjacent to them and when the bark is peeled off the wood immediately under it will be found to be of a brownish colour in the first stages, and later quite dead. This disease, if handled at once can easily be cured; first remove the soil from around the root for about 18 inches, cutting away all diseased bark and wood and applying white-wash, with a little coal tar added, to the cut surfaces and allowing the hole to remain open until filled up by the natural washing of the rains.

"Die Back" as its name denotes, is a dying back of new growths and smaller branches. This is due to the application of highly nitrogenous manures and also wet soil; if these causes are removed and some dry wood ashes applied to the root system the trees will soon recover.

"Scale Insects" are more prevalent in densely shaded groves and poorly fed trees. They exist under the most favourable conditions and if not checked will eventually kill the tree. For these pests soft soap emulsion is a good remedy, but it has to be repeated until you have eradicated the pests, and ever after keep a watchful eye for the return, dosing them as soon as they make an appearance.

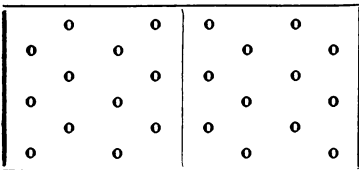
What I have told you will be quite enough to give a fair start and if you follow out my instructions as regards planting and growing the catch crops I have mentioned, you will find at the end of about four years you will have a nice grove that will be capable of helping out your income and which has cost you almost nothing as far as ready money is concerned.

I hope I have not wearied you with this long string of details, but they are all quite necessary to entail success and must be carefully followed.

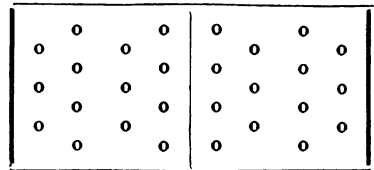
Now there is the other part of my discourse which I will treat as briefly as possible, and that is the marketing of citrus fruits. The present system I think is an impossible one, and is bound to bring ruin sooner or later to all concerned in it. I am sorry to have to say it, but our ordinary labourer is far too careless an individual to be trusted to pick and handle oranges and grape fruit all over a property as is now done. To get good work you must personally supervise the picking, and this is not possible where you have to employ dozens of hands scattered over a large area. In a grove it is different as the trees are blocked together and you can take row by row; then the trees being of lower growth, most of the fruits can be picked directly from the ground or from short ladders, put in small canvas bags hung from the shoulder and these

when filled emptied into the field boxes, which in turn can be carted to the packing house instead of the fruit being bulked in a cart as is done at present. Citrus fruits should at all times be handled as carefully as eggs; in picking, if an orange should drop on the ground destroy it at once, do not let that orange get in your pack as it will be sure to rot and contaminate others. If possible clip the oranges directly from the trees as by doing this the buds immediately behind the oranges, which will form the growth for the succeeding crop, are not destroyed as is done when a part of the stem is picked from the tree along with the fruit. After picking, oranges should be placed in thin layers in the packing house, remaining thus for at least four days before packing and grape fruit at least a week; by that time the skins have become tough and all bruises are easily recognised. All fruits bearing these marks should be discarded. The fruit is now ready for packing operations. First all fruit should be divided into three classes, brights or fully ripe and clean, secondly, fully ripe but discoloured or russet, and thirdly, greenish fruit; then each of these grades must be sized and packed separately. Now wrap in tissue paper, if possible bearing the packer's Trade Mark, then pack in Standard size boxes, each box holding according to the size of orange or grape fruit the following number of fruit. The standard packs for oranges are 96, 112, 126, 150, 176, 200, 216, 225, 250; smaller oranges than these are generally classed as unmarketable. Grape fruit are packed in the following sizes.

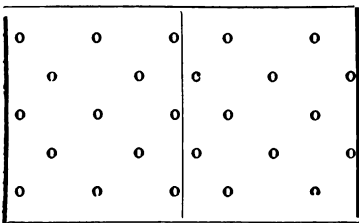
The method of placing oranges in the box to get them to hold the exact quantity is illustrated by the following diagrams* :—



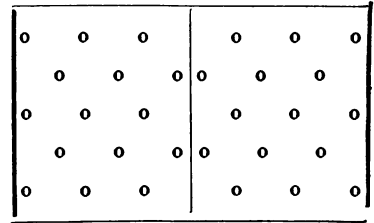
1 Packing 96 to the box; four layers, alternating, as in A and B.



2-Packing 112 to the box; four layers, alternating, as in A and B.

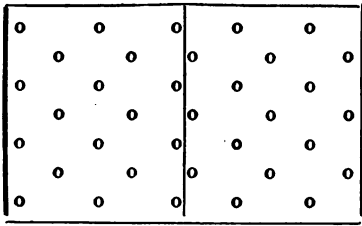


3—Packing 126 to the box; first, third and fifth layer as in A, and second and fourth layer as in B.

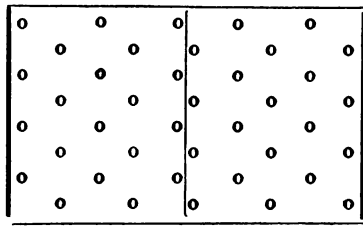


4—Packing 150 to the box; five layers, alternating, as in A and B.

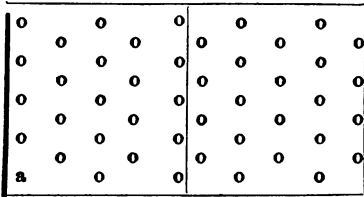
* See Bulletin of the Botanical Department, December, 1895, page 283.



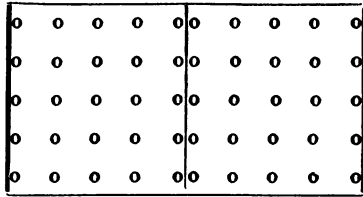
A **B**
5—Packing 176 to the box; first, third and fifth layers as in A, and second and fourth layers as in B.



A **B**
6—Packing 200 to the box; five layers, alternating, as in A and B.



A **B**
7—Packing 225 to the box; five layers, alternating, as in A and B.



A **B**
8—Packing 250 to the box; five uniform layers.

Always remember that neatness counts for much in putting up oranges. After packing slightly above the edges of the box, this is as it should be, in putting on the cover use gentle pressure distributed as even as possible over the whole surface to get the fruit to settle down; then nail on the cover with three straps, which should go completely around the box; neatly stencil your mark and despatch. All this of course refers to the packing of boxes. With barrels it is different. The oranges should be allowed to remain in the house as before, and as it is unnecessary to size as with boxes, this operation is saved. Neither is it advisable to wrap in tissue paper; ordinary straw paper being the kind adopted. It is not generally known that it requires an expert to properly pack a barrel of oranges, but nevertheless such is the case, and this is how it should be done. First search the barrel well for any nails that may be protruding inside through carelessness of the cooper, then start by packing oranges around the outer edge of the bottom of the barrel, using a slightly smaller size of orange for the first row round than you intend to put in the middle part; this will compensate for the inside lining. Turn all the whorls of the paper up for about four layers and see that as far as possible each layer after the first one contains the same size oranges, as the object should be to get each layer exactly level before starting another one. Never use your thumb to push an orange in place; you are sure to injure it, but use all your fingers to give a gentle pressure sideways to each orange; when you come to the centre, if space allows, put in three oranges at once and use the palm of your hand to gently firm the three down into their place and so act as a wedge against all the others; continue each row like this until you come to the last, which should just come level with the top of the barrel. Place the heading on top of the oranges and give the

barrel a slight but sharp rocking motion to and from you, pressing the top down with your elbows in the meantime; on uncovering you will find that the fruit has settled down just to the chine of the barrel; after heading up, stencil and despatch.

With these details I must bring my lecture to a close, but before doing so, let me seriously impress on all of you, the desirability, in fact the absolute necessity, of the better handling of our fruit. An orange or grape fruit is not an India rubber ball, but a fragile fruit, which if properly handled can be kept for months so long as it is well ventilated, but if bruised at all will be decayed and unfit for anything after a few days, and in some instances, after a few hours. Your obligations are not over when you have nailed the heading down; they continue until the fruit reaches the consumer and he finds it the article you represent it to be. You call the shopkeeper a dishonest and unscrupulous man who sells you an article that is not up to that standard he represents it to be; well the same name applies to the packer who gets an order for good marketable fruit, but instead puts up half rotten and unmarketable stuff or handles the fruit carelessly and so jeopardises its keeping qualities. Also remember that you are not only injuring your own name by pursuing this dishonourable course, but that of your country and its products in the markets abroad, and that if some reformation is not immediately started these same markets will be forever closed to all of us.

TOBACCO OF JAMAICA :— VI.*

A

32 S.S. 371

Colonial Secretary's Office, 30th January 1906.

SIR,

I am directed to transmit herewith, to be laid before the Jamaica Agricultural Society, for their information and for publication should the Board of Management so desire, a copy of a despatch from the Secretary of State for the Colonies, enclosing copy of correspondence in regard to Mr. F. V. Chalmers' experiment of blending Jamaica with Virginia tobacco for use in the Navy.

I have the honour to be,

Sir,

Your obedient Servant,

T. L. ROXBURGH, Asst. Col. Sec.

371

Downing Street, 30th October, 1905.

Governor Sir J. A. Swettenham, K.C.M.G., &c., &c., &c.

SIR,

With reference to my despatch No. 347 of the 6th inst., and to previous correspondence, I have the honour to transmit to you for your information, the accompanying copy of a letter from Mr. F. V. Chalmers relative to the supply from Jamaica and other British

* Continued from *Bulletin of the Department of Agriculture* Dec. 1905 page 271.

Colonies of the tobacco required for His Majesty's Naval service, together with copies of correspondence with the Admiralty on the subject.

I have, etc.,
(Sgd.) ALFRED LYTTTELTON,

13 Devonshire Square, Bishopsgate, E.C.,
20th September, 1905.

C. P. Lucas, Esq., C.B., Colonial Office.

SIR,

I have the honour to report to you the result of my interview with you some time since, upon the introduction of Sir Alfred Jones. I have been twice to the West Indies, Jamaica, and have also reported upon growths from Barbados and St. Kitts to the Imperial Commissioner of Agriculture. At the request of the Lords of the Admiralty, I blended and manufactured 8,657 tins of tobacco by way of experiment for the Navy, and I am pleased to tell you that the production is second to none. Should this meet with the approval of the seamen, it will give a great impetus to the West Indian Tobacco Industry, and I see no reason in future, if proper care and advice are given, why the whole of the tobacco for the Navy should not be composed of tobacco grown in one or other of the Colonies, entirely eliminating foreign growth. Such being the case, Colonial tobacco would vie with American or any other growth. In other kinds of tobacco, I have advised Jamaica to experiment and the results are most gratifying, and I have reported that in my opinion, with some small modifications the productions should compete with Havana and Sumatra, and I am told the increase in acreage this year is to be very considerable, but this experiment will have to be watched most carefully and continuously or there will sure to be delay, if not relapse.

I am, etc.,
(Sgd.) F. V. CHALMERS.

33923-1905

Downing Street, 26th September, 1905.

The Secretary to the Admiralty,

SIR,

With reference to your letter of the 15th of December last, (V. 8192) relative to Mr. F. V. Chalmers' suggestion for the supply from British Colonies of the tobacco required by His Majesty's Naval service, I am directed by Mr. Secretary Lyttelton to acquaint you, for the information of the Lords Commissioners of the Admiralty, that he understands that 8,657 tins of West Indian tobacco have been supplied by Mr. Chalmers for the Navy, by way of experiment, and I am to state that Mr. Lyttelton would be glad to be informed of the result of this experiment.

I am,

(Sgd.)

C. P. LUCAS.

Admiralty, S.W., 21st October, 1905.

The Under Secretary of State
for the Colonies, Downing Street,
SIR,

I am commanded by my Lords Commissioners of the Admiralty to acknowledge the receipt of Mr. Lucas' letter of the 26th ultimo, No. 33923/1905, on the subject of the supply from British Colonies of the Tobacco required for H. M. Naval service.

2. In reply, I am to acquaint you for the information of the Secretary of State for the Colonies, that with the assistance of Mr. Chalmers, the Admiralty obtained a supply (1,508 lb.) of Leaf Tobacco from Jamaica, but, as it transpired that this tobacco by itself was not suitable for pipe smoking and that there is not at the present time any Colonial grown Tobacco suitable for blending with it, arrangements were made for it to be blended and manufactured with a quantity of Virginia grown Tobacco, the proportion being 1,508 lb. Jamaican to 5,075 lb. Virginian. This preparation is now undergoing trial in the Fleet and my Lords will be happy to communicate the general results of the experiment in due course.

3. As, however, more than 75 per cent. of the blend now under trial is of American origin, it is evident that this test does not go very far in the direction of substituting Colonial for Foreign grown Tobacco, and it is doubtful whether such a step is practicable at the present time. It is true that My Lords are informed that much attention is being given to the cultivation of Tobacco in Victoria and Rhodesia, and that it is hoped eventually to produce there a type possessing the same qualities as that now grown in Virginia, and therefore suitable for blending with West Indian Tobacco. But planting in these Colonies seems to be, as yet in the experimental stage, whilst, so far as their Lordships are aware, supplies even of Jamaica Tobacco, are not at present procurable in the open market in any quantity.

4. In the event, therefore, of the present trial proving successful, it must still be a matter for careful consideration whether any reliance can be placed upon obtaining regular and sufficient supplies of Colonial grown Tobacco at a reasonable price, and it would be very helpful to their Lordships in dealing with this question if they can be given fuller information with regard to the position and prospects of the Tobacco planting industry in the Colonies generally, and also as to whether the Secretary of State is preparing to take any special action in regard to the promotion of Tobacco cultivation which will be likely to assist the Admiralty in obtaining adequate supply from Colonial sources.

I am, etc.,
(Sgd.) GEO. H. HOSTE, Pi. Sec.

B

The following paragraphs are taken from a letter of a correspondent in Africa, who has had considerable experience in growing Sumatra tobacco in Sumatra. His notes will be of great

interest to those who are engaged in the cultivation of this tobacco in Jamaica :—

Many thanks for Bulletin of July, 1905, which I have read with interest. I have further received your letter of the 12th October and in reply to your query *re* fermentation.

A light coloured leaf in Sumatra tobacco by no means implies want of fermentation. Most of the cigar manufacturers are under the impression that fermentation darkens the leaf, which it does of heavy tobacco, but a certain proportion of Deli leaf is very light coloured (L. sorting mark) and sells at the highest price for the American's in the Amsterdam market.

My experience is that a cigar manufacturer of course knows whether a leaf suits him or what its faults are, but when they try to find a reason or suggest a remedy for these faults, they are at sea, because they have no experience as growers.

Twenty* tons is a good weight of Sumatra leaf to ferment ; less would probably be insufficiently fermented, therefore this tobacco is not a poor man's business.

With regard to your Bulletin, which is of great interest to me, you may like to have the following notes, but having no experience of your climate or soil, of course they must be considered merely in the light of Sumatra and African experience, and for this reason may not be of great value.

Topping—I see you did not top apparently, but let the plants flower. If I remember aright, this was done also in the Connecticut Valley ; it was also tried in Deli about 1897, but abandoned in favour of the old plan of topping, as it was found the leaf by not topping was too papery to work, also the lengths were poor.

Age of plant when harvested—The quicker the growth the finer the leaf of course. In Deli, 100 to 110 days, from date of sowing to harvesting, is the rule.

Curing—Yours is the first attempt I have seen to grapple with the problem of too rapid curing in the Bam ; a state of affairs which seems to prevail everywhere I have tried Sumatra tobacco, except in the very moist atmosphere of Sumatra itself.

Here we ran three streams in furrows through the C. Bams day and night while the tobacco was curing, also watered the floor heavily, with however but little effect ; the dry bulb of Psychrometer still showed 10° and 12° difference to the wet one, consequently the leaf cured blotchy.

I should like to try the method of hanging the cloth round Bam but should think it expensive. I note you partly sweated the leaf on floor before hanging to turn it yellow. Perhaps in your climate this may do well, but in Deli we were specially warned against this, as "green sweat" is said to give the leaf an acrid flavour, impossible to eradicate by fermentation.

* A press of half a ton of Havana tobacco ferments well, and if part of this, say 90 lbs., be Sumatra, the latter is fermented. *Editor.*

Fermentation—Your tobacco would appear to have followed the lines of the American Sumatra leaf in the Washington bulletins which perhaps suits that leaf, but it is quite different to a Deli ferment.

For instance, you ran it up on first bulking to 125 F. 52 C. I should have turned it at 40° once or twice, and then brought it gradually up to 52° or higher, but of course all depends on how the tobacco looks when turned.

Too rapid fermentation makes the leaf first tender then weak, and an excessive rise in temperature may burn it altogether. Too slow and you dry it out, so it's like fly fishing, cast too fine or too coarse and you lose your fish.

It would seem the climate of Jamaica is very suitable for the growth of a nice cigar leaf, and I trust that your experiments will induce growers to take it up.

Our shade unfortunately was blown right away in a storm, so I have no shade tobacco in Bam. The plants were about 3 feet high, growing fast and gave every promise of being a fine leaf, so I was sorry.

Perhaps later you would feel inclined to exchange samples of our fermented leaf. I am just beginning fermentation now and will be finished about March.

I find a good plan is to get a few bundles of Sumatra leaf to keep by one as a standard.

A NEW NAME FOR A JAMAICAN FERN.*

By WILLIAM R. MAXON.

In the first fascicle of Christensen's Index Filicum (1905), *Acrostichum lomarioides*, Jenman, a middle American species, is reduced to *A. aureum*, L., supposed to be dispersed generally throughout the tropics. In first proposing *lomarioides*, Jenman suggested that *A. aureum* might prove an aggregate of several more or less closely related species; and arguing from analogous cases we judge this to be likely. But at present we are concerned only with *lomarioides*, described at length by Jenman; this and *aureum* he held to be as distinct as "any two closely allied species in any genus." Several recent writers have not held to this opinion; but from field observation and the collection of adequate material we are quite convinced that the two are, as Jenman has said, absolutely distinct, and we shall try to prove this conclusively in a later paper.

Jenman's use of *lomarioides* for an American plant is, however, invalidated by the earlier application of the same name to an East Indian species, by Bory. In its stead we propose, with the same type:

Acrostichum excelsum nom. nov.

Chrysodium lomarioides, Jenman, Timehri 4: 314. 1885.

Acrostichum lomarioides, Jenman, Bull. Bot. Dept. Jamaica.

II. 5: 154, 1898.

Not Bory, Belang. Voy. Bot. 2: 21. pl. 2. 1833.

* Proc. of The Biological Society of Washington. Vol. XVIII. Oct. 17. 190

The type of Jenman's species is from British Guiana, but the plant occurs also in Jamaica, Porto Rico, Florida, Mexico and Guatemala.

SELECTION OF SEED : COCO-NUTS.

The coprah produced by 1,000 Ceylon ordinary nuts is about twice as much as that obtained from Seychelles nuts. This result has been obtained in the same soil, under the influence of the same climate, and is entirely due to selection. It is to be hoped that the discussion raised on the subject by the planters after their having seen the nuts introduced from Ceylon may prove the beginning of a careful selection of nuts for planting in Seychelles. Many of them have already informed me that they have found on their estates a few of their trees producing nuts similar to those of Ceylon and that they intend keeping them for propagation. It is probable that the trees which produce very small nuts have less requirements than those which produce bigger nuts, and that varieties which produce big nuts normally will bear smaller nuts if they are starved out. But when one thinks of the very trifling amount of plant food which is removed from the soil by coconut cultivation, there seems to be no difficulty in supplying the elements which are required to a greater extent by the big-nut varieties. The planter must choose between having small nuts without trouble and having double the crop by using proper methods and selection.—*Annual Colonial Report, 1904, Seychelles.*

BOARD OF AGRICULTURE.

EXTRACTS FROM MINUTES.

The usual monthly meeting of the Board of Agriculture was held on Tuesday, 13th February, at Headquarter House. Present : the Director of Public Gardens, the Island Chemist, His Grace the Archbishop, Messrs. C. A. T. Fursdon, C. E. deMercado, J. W. Middleton, and the Secretary.

The Secretary read an apology for absence from the Chairman, Hon. H. C. Bourne, intimating that there was a meeting of the Privy Council which he had to attend at the same hour, and asking that Mr. Fawcett might take the chair.

The Secretary read minutes of previous meeting which were confirmed.

The Archbishop asked leave to bring up a matter he had mentioned at last meeting, viz. : the question of a Jamaica Agent in London to protect and facilitate their commercial interests. The same matter had been discussed some years before by the Merchants' Exchange and such an appointment had been approved of, the only objection being lack of money. Mr. Middleton in support of the proposal, moved that a Committee be appointed.

The Chairman asked the Archbishop and Mr. Middleton to form this Committee, and make a report to the Board on the subject.

As the day and hour of the meeting of the Board so often clashed with the meeting of the Privy Council, it was resolved to alter the day to the Monday of the same week in the month, at the same hour.

The Secretary read the following letters from the Colonial Secretary's Office :

- 1 Authorising publication of Mr. Edward Redsue's letter re Sweetmeat Factory.

In connection with this the Secretary said that sweetmeats were now being made at the Barossa Creamery and the person doing so had promised to experiment in the direction mentioned, namely rum and lime juice tablets.

2. Sending copy of report of the Second International Congress of Master Cotton Spinners & Manufacturers Association.

This was directed to be circulated.

3. Reports from Mr. Nolan giving results of his work in the United Kingdom.

With regard to the matter of the use of steam coils in Jamaica pot-stills especially referred to the Board, the Secretary stated that to save time he had sent the papers to the Chemist for his opinion which he now presented. This was read together with a list of the estates using steam coils.

It was resolved to advise the Government "that it was the opinion of the Board that the contention that steam heat is injurious cannot be maintained and that the erroneous impression arises from a confusion of pot-stills heated with steam coils, and continuous stills in which the liquor is brought into direct contact with the live steam."

The Secretary was directed to forward this resolution to the Government together with a copy of the Chemist's minute and list of estates using steam coils and results of their crops, for the information of Mr. Nolan.

4. Letter from the Imperial Commissioner of Agriculture for the West Indies sending copy letter to him from Mr. F. V. Chalmers advising satisfactory results of a blend of Jamaica Tobacco in that issued to the Navy.

The Secretary submitted Draft Contagious Diseases Animals Bill as revised by a joint committee of the Board and the Agricultural Society and said the draft had been submitted to the members of the Committee and Penkeepers for further revision or suggestions.

The Secretary submitted letter from Mr. E. A. dePass, London, to the Chemist giving opinions re the commercial aspects of High Ether Rum on the Continent.

This was directed to be circulated.

The following reports from the Chemist were submitted :

1. re Award of Scholarships reporting that of seven candidates who had competed for three scholarships, only one candidate, Mr. L. L. Carrington, attained a standard of over half marks and recommending that he be awarded a Scholarship and the other two be held in abeyance.

This was agreed to.

2. Asking authority to publish the results of the Sugar Experiment Station work for 1905 in the form of a special report, which was granted.
3. Asking authority for the purchase of a steam-heated pan from Mr. Lazarus, Kingston, at a price not to exceed £15 to be charged to "Alterations" and New Plant for Estates Distilleries on the estimates of the Sugar Experiment Station.

This was granted.

The following reports from the Director of Public Gardens were submitted :—

1. Report Hope Experiment Station.
2. " Instructors.

These were directed to be circulated.

The Secretary reported that Mr. Sharp advised safe receipt of the Steam Gin and that it had been erected in the Ginnery at Eltham and was in good working order ; also safe receipt of the Baler from the railway workshop, also found in good order. Owing to the heavy loss on cotton by his Company through caterpillars, Mr. Sharp said he would be unable to make an offer for these at present.

The Secretary stated that although he had written several times to Mr. Levy of Brown's Town to return the Hand Gin which he had not been able to get in working order, it had not yet been sent back. One Cotton Gin was in the hands of the Black River Agricultural Society and one with Mr. Shore at Little River, and one retained in the office.

The Secretary submitted a small book by Mr. E. J. Wortley entitled "Agricultural Practices and Morals" and which embodied a list of the "Agricultural Don'ts" prepared for the Board for use in Schools. The Board's approval of the Book was asked.

☛ This was directed to be circulated.

☛ The following papers which had been circulated, but had not yet been before the Board were now submitted :—

1. Notes on School Gardens together with notes by Mr. Cradwick and comments by members of the Board.

All these were directed to be returned to Mr. Williams.

2. Itinerary of Mr. Hirst, Instructor in St. Catherine.

The following papers which had been circulated were submitted for final consideration :—

1. Agricultural Scholarships' Examination.
2. Report : Work of Agricultural Students for Michaelmas Term.
3. Report on Banana Soils in St. Mary.
4. Progress Report Distillers Experiments.
5. Appointment of two assistants, Sugar Department.
6. Report Hope Experiment Station.
7. Report Mr. Cradwick.
8. Letter from India re Bananas.
9. Lettter from Mr. Sydney Olivier re Locked Still.

SEASONS AND PRICES FOR FRUITS, VEGETABLES, AND OTHER ECONOMIC
PRODUCTS IN KINGSTON, JAMAICA.

Compiled by Wm. Harris, F.L.S., Superintendent of Hope Gardens.

As there is a good deal of misapprehension with regard to the seasons for the various crops grown in Jamaica, and the duration of the season for each crop, the compiler visited the principal market in Kingston once a week for twelve months for the purpose of noting the various products offered for sale, and the prices charged to consumers. These prices are at least one-third, and frequently three or four times higher than the prices paid by the retail dealers to the growers of the commodities enumerated. The prices noted for economic products such as ginger, anatta, &c., were those paid by a large exporting firm to the producers.

It will be readily understood that the seasons vary somewhat according to prevailing weather conditions, and the prices also vary according to supply and demand.

Approximate Seasons for, and prices in Kingston, of fruits, vegetables and other products.

Common name.	Botanical name.	Seasons and prices in Kingston Market.
<i>Fruits.</i>		
Banana	Musa sapientum	Throughout the year—1½d. to 3d. per dozen fingers.
Blackberry	Rubus jamaicensis	June to November—4d. to 9d. per quart.
Bilberry	Vaccinium meridionale	Summer months—4d. to 6d. per quart.
Cashew fruits	Anacardium occidentale	May to August—3d. to 4d. per dozen.
Cashew nuts	Anacardium occidentale	May to September—1½d. to 3d. per quart.
Coco-nuts—dry	Cocos nucifera	Throughout the year—9d. to 1s. per dozen.
Coco-nuts—green	Cocos nucifera	Throughout the year—1s. to 1s. 6d. per dozen.
Cherimoya	Anona Chermolia	October to February—1d. to 3d. each.
Custard Apple	Anona reticulata	Plentiful November to middle of February; scarce during remainder of the year—1s. per dozen.
Ginep	Melicocca bijuga	August and September—½d. to 1½d. per bunch.
Granadilla	Passiflora macrocarpa	Throughout the year, but most plentiful during the winter months—3d. to 6d. each.
Grape Fruit	Citrus decumana	Scarce April to August—10s. to 12s. per 100; fair supply August to November—8s. to 10s. per 100; plentiful November to end of March—5s. to 10s. per 100.
Grapes—black	Vitis vinifera var.	Scarce and poor January to March—1s. 6d. per lb., none middle March to end of May; June to end of year fair supply—1s. to 1s. 3d. per lb.
Grapes—white	Vitis vinifera var.	None in the early part of the year; scarce and poor April and May—2s. per lb., June to end of year fair supply—1s. 6d. to 2s. per lb.

Common name.	Botanical name.	Seasons and prices in Kingston Market.
Lime	<i>Citrus medica</i> , var. <i>acida</i>	Scarce and green April to August—fairly plentiful end of August to December; plentiful December to March—1s. per 100.
Mango, Numerous varieties	<i>Mangifera indica</i>	The regular season for this fruit begins in April and prices for No. 11 and other favourite varieties are then 3d. per dozen. The fruit is very plentiful from middle of June to end of August, and prices drop to ½d. per dozen. From October to May the fruit is occasionally seen in the market, and the price is ½d. to 1d. each, according to variety and quality.
Melon	<i>Cucurbita Melo</i>	Winter and spring months—4½d. to 9d. each.
Melon Cantaloup	<i>Cucumis Melo</i>	Plentiful during the spring, autumn and winter months—6d. to 9d. each.
Melon—Musk	<i>Cucurbita moschata</i>	Plentiful during winter and spring months; scarce and poor March to end of August—6d. to 9d. each.
Melon—Water	<i>Citrullus vulgaris</i>	Throughout the year, but most plentiful during the autumn and winter months—9d. each.
Naseberry	<i>Achras Sapota</i>	Plentiful April to middle of June—3d. per dozen; scarce middle of June to July. 4½d. to 6d. per dozen; none July to October then fairly plentiful to April—4½d. to 6d. per dozen.
Orange—Sweet	<i>Citrus Aurantium</i>	Scarce June to end of August—3s. to 4s. per 100; fairly plentiful September to November—3s. to 4s. per 100; plentiful November, to end of May—2s. to 3s. per 100.
Orange—Tangierine	<i>Citrus nobilis</i>	Scarce during June; none July and August; fair supply September to November; plentiful November to end of May—6d. per dozen.
Papaw	<i>Carica Papaya</i>	Throughout the year—1d. to 2d. each.
Pine-apple Bull-head	<i>Ananas sativa</i> , var.	Rather scarce September to March—5d. and 6d. each; fair supply March to May—4½d. to 6d. each plentiful May to end of August—2d. to 6d. each.
Pine-apple Ripley	<i>Ananas sativa</i> , var.	Same seasons as previous—3d. to 6d. each when plentiful; 6d. to 1s. each when scarce.
Pine-apple Sugar-loaf	<i>Ananas sativa</i> , var.	Same seasons and prices as for Bull-head.
Pindar-nut	<i>Arachis hypogæa</i>	Throughout the year—1½d.—2d. per quart.
Shaddock	<i>Citrus decumana</i>	Plentiful November to June, and to be had all through the year—6d. each.
Sour Sop	<i>Anona muricata</i>	Plentiful December to June—1d. to 2d. each; scarce in July—3d. each; none August and September; scarce in October and November—3d. each.

Common name.	Botanical name.	Seasons and prices in Kingston Market.
Star-apple	Chrysophyllum Cainito	Scarce during February—1s. per dozen.; plentiful March to beginning of June—3d. to 9d. per dozen; scarce during latter part of June—1s. per dozen; none from early part of July to February.
Sweet Cup	Passiflora mali- formis	Throughout the year—1½d. to 3d. per dozen.
Sweet Sop	Anona squamosa	None from February to early part of June; fairly plentiful middle of June, and plentiful July to September; then a fair supply to end of January—3d. to 9d. per dozen.
<i>Vegetables.</i>		
Akee	Blighia sapida	Plentiful July to October—½d. per dozen; November to end of June not plentiful—1½d. to 2d. per dozen.
Avocado, or Alligator Pear	Persea gratissima	Season begins early part of July, and pears are plentiful to end of September—½d. to 1½d. each; scarce from October to end of April—1d. to 2d. each; none during May and June.
Beans—French	Phaseolus vulgaris	Throughout the year, but most plentiful during the autumn and winter months—2d. per lb. when plentiful, to 6d. per lb. when scarce.
Beans—Lima, or Sugar	Phaseolus lunatus	Throughout the year—4½d. to 6d. per quart.
Beetroot	Beta vulgaris	Throughout the year, but most plentiful and best during winter and spring months—9d. to 1s. per dozen.
Breadfruit	Artocarpus incisa	Throughout the year; most plentiful December to March—1d. to 2d. each.
Cabbage—native grown	Brassica oleracea	Throughout the year; best during winter and spring months—4½d. to 9d. each, according to size.
Calalu or Spinach	Amarantus viridis A. gangeticus A. spinosus	Throughout the year; very plentiful during and after the rainy seasons—1d. to 1½d. per bunch.
Calalu, Jockatoe (See also Indian Kale)	Phytolacca octandra	Throughout the year—1d. to 1½d. per bunch.
Carrot	Daucus Carota	Throughout the year; best during winter and spring months—1½d. to 3d. per bunch.
Chocho—White and Green	Sechium edule	Throughout the year, most plentiful November to end of February—3d. to 6d. per dozen when plentiful, 6d. to 1s. per dozen when scarce.
Cocoas	Xanthosoma sagittaeifolium	Throughout the year, most plentiful November to March—6d. to 9d. per dozen tubers.
Corn, Indian or Maize—Green Corn	Zea Mays	June to August, and October to December—6d. to 9d. per dozen cobs

Common name.	Botanical name.	Seasons and prices in Kingston Market.
Corn, Indian, or Maize—Sweet Corn, or Sugar Corn	<i>Zea Mays</i>	June to August, and October to December— 6d. to 9d. per dozen cobs.
Cucumber	<i>Cucumis sativus</i>	Throughout the year, small but plentiful— 6d. to 1s. per dozen.
Garden Egg	<i>Solanum</i> <i>Melongena</i>	Throughout the year 9d. to 1s. 6d. per dozen
Gourd, Bottle, or Sweet	<i>Lagenaria vul- garis</i>	Throughout the year, but most plentiful during the cool months of the year—3d. to 6d. each.
Indian Kale, Calalu, or Spinach	<i>Xanthosoma</i> <i>atrovirens</i>	Throughout the year—1s. to 1s. 6d. per dozen bunches.
Lettuce	<i>Lactuca sativa</i>	Throughout the year—6d. to 1s. 6d. per dozen heads.
Ochra	<i>Hibiscus</i> <i>esculentus</i>	Throughout the year—2d. to 6d. per lb.
Parsley	<i>Carum Petro- selinum</i>	Throughout the year—1d. to 1½d. per bunch.
Pea—English, or Green	<i>Pisum sativum</i>	During the winter and spring months, not plentiful—3d. to 6d. per dish
Pea—Black-eye	<i>Vigna Catjang</i>	Throughout the year, but most plentiful April to June, and October to December— 3d. to 6d. per quart.
Pea—Gungo, Congo, or Pigeon—dry	<i>Cajanus indicus</i>	Throughout the year—3d. to 6d. per quart.
Pea—Gungo, Congo, or Pigeon—green	<i>Cajanus indicus</i>	Throughout the year—2½d. and 3d. per quart.
Pea—Red Kidney Bean, Haricot Bean	<i>Phaseolus</i> <i>vulgaris</i>	Throughout the year, but most plentiful March to June, and November to Decem- ber—4½d. to 6d. per quart.
Plantain	<i>Musa sapientum</i> , var. <i>paradisiaca</i>	Throughout the year—½d. to 1d. each finger.
Potato—Irish	<i>Solanum tuber- osum</i>	During the winter and spring months—1½ to 2d. per lb.
Potato—Sweet	<i>Ipomoea Batatas</i>	Throughout the year—½d. to ¾d. per lb., or 4s. to 5s. per 100 lbs.
Pumpkin	<i>Cucurbita Pepo</i>	Throughout the year—4½d. to 6d. each.
Scallion	<i>Allium fistulosum</i>	Throughout the year, but most plentiful during the cool months—1½d. to 3d. per bunch, according to size.
Spinach (See Calalu, and Indian Kale)		
Tomato	<i>Lycopersicum</i> <i>esculentum</i>	From February to July, plentiful and good —3d. to 4½d. per lb. ; from July to Febru- ary, fair supply medium quality—4½d. to 6d. per lb.
Turnip	<i>Brassica Rapa</i>	Throughout the year, but plentiful and good during the winter and spring months—1½d to 3d. per bunch.

Common name.	Botanical name.	Seasons and prices in Kingston Market.
Water Cress	<i>Nasturtium officinale</i>	Throughout the year—1d. to 1½d. per bunch.
Yam—Negro, Lucea, &c.	<i>Dioscorea sativa</i>	June to December—7s. to 10s. per cwt.
Yam, White, Guinea, Barbados, &c.	<i>Dioscorea alata</i>	January to May—10s. to 12s. per cwt.
Yam—Yellow or Afou	<i>Dioscorea cayennensis</i> var. <i>rotunda</i>	January to June, and August to end of year—8s. to 10s. per cwt.
Yampee, or Indian Yam	<i>Dioscorea trifida</i>	Throughout the year, but most plentiful during the autumn, winter and spring months—6d. to 2s. per dozen according to size.

ECONOMIC PRODUCTS.

Common name.	Botanical name.	Seasons and prices paid by Merchants to Growers.
Anatta	<i>Bixa Orellana</i>	25s. to 30s. per 100 lbs. Crop from Dec. to end of May.
Bitterwood	<i>Picraena excelsa</i>	30s. to 34s. per ton of 20 cwts., 6s. per ton extra for free on board. From April to October there was no demand and no trade.
Cocoa	* <i>Theobroma Cacao</i>	32s. to 34s. per 100 lbs. in January with a gradual rise to 44s. per 100 lbs. in March when the spring crop closed; 40s. to 41s. per 100 lbs. for middle year crop—Middle of May to end of July; 40s. to 44s. per 100 lbs. for autumn crop, starting in September and lasting to end of year.
Coffee (Fancy)	* <i>Coffea arabica</i>	36s. per 100 lbs. in January to May, and 34s. to 40s. in June when crop finished. No business July to middle of October, when new crop started at 36s. per 100 lbs. dropping to 34s. in November and December.
Coffee (Fine)	<i>Coffea arabica</i>	33s. per 100 lbs. in January to June when crop finished. No business July to middle of September, when new crop started in Manchester at 30s. per 100 lbs. This price was maintained to middle of October when all crops started and the price advanced to 32s. dropping to 30s. again in middle of November and remaining at that figure to end of year.

* All the produce of Estates is sent direct to London or Liverpool. Cocoa gets 52s. Blue Mountain Coffee realises as high as 130s.

Common name.	Botanical name.	Seasons and prices paid by Merchants to Growers.
Coffee (Ordinary)	<i>Coffea arabica</i>	28s. to 30s. per 100 lbs. in January to end of crop in June; no business to beginning of September when new crop started in Manchester at 20s. per 100 lbs., this price was advanced to 22s. during September and remained at that figure to middle of October when all crops came in and the price rose to 23s. and 24s. at the beginning of November; in the middle of November the price dropped to 22s. at which figure it remained to the end of the year.
Coffee (Good Ordinary)	<i>Coffea arabica</i>	30s. per 100 lbs. at beginning of January to end of crop in June. This grade of coffee continued to appear after the end of the crop in June to the opening of the new crop in Manchester at the end of August when the price dropped to 23s. per 100 lbs.; this price was maintained to beginning of November when it rose to 26s. and remained at this figure to the end of the year.
Coffee (Parchment)	<i>Coffea arabica</i>	20s. per cwt. (112 lbs.) at beginning of January rising to 21s. by middle of the month, and 24s. by end of the month. During February to end of March the price remained steady at 15s. per cwt., it then rose to 16s. and remained at that figure to middle of May when it went up to 24s. per cwt. From middle of August to middle of Oct. none was offered, then all crops came in and the price started at 20s. per cwt. and remained at that figure to end of the year.
Divi-divi	<i>Cæsalpinia coriaria</i>	5s. 3d. per cwt. for large quantities, sellers finding their own bags; 4s. 6d. per cwt. for small quantities—January to June. In December the prices paid were £5 per ton for large quantities and £4 10s. per ton for small quantities.
Fustic (roots)	<i>Chlorophora tinctoria</i>	From January to middle of April 35s. per ton (20 cwt.) and 6s. extra for free on board; during May and early part of June 39s. per ton; June to beginning of August 43s.; August and September 48s.; October to end of November 40s. and during December 36s. per ton.
Fustic (trunks)	<i>Chlorophora tinctoria</i>	From January to middle of April 48s. per ton of 20 cwt., and 6s. extra for free on board; May to early part of June 52s.; from middle of June to end of September, 56s.; from beginning of October to end of November 48s. and during December 44s. per ton.

Common name.	Botanical name.	Seasons and prices paid by Merchants to Growers.
Ginger	<i>Zingiber officinale</i>	January 25s. to 28s. per 100lbs. ; in February 26s. to 28s. ; from February to end of April, 28s. ; May, 32s. to 34s. ; June, 36s. ; crop all reaped ; July, 32s. ; August, 35s. per 100lbs. No trade after early part of August to middle of December when crop started at 24s. per 100lbs.
Kola-nuts	<i>Cola vera</i>	Crop starts in March. No trade before June when 12s. 6d. per 100lbs. was paid for fresh nuts. This price advanced to 15s. per 100 lbs. by middle of June and dropped to 8s. in July for cured nuts. It remained at 8s. to end of crop. The trees give 2 crops—Mar. to June, and Aug. to Nov. From January to June 34s. per ton of 20 cwts., and 6s. extra for free on board. From middle of June to end of year 50s. per ton. For local consumption at Chemical Works the price paid is equal to shipping rates free on board.
Logwood (roots)	<i>Haematoxylon campechianum</i>	48s. per ton (20 cwts.) at wharf, 6s. extra for free on board, Jan. to middle of April ; 52s. May and June ; 50s. to end of year.
Logwood (trunks)	<i>Haematoxylon campechianum</i>	10s. to 11s. per 1,000 January and February ; 12s. 6d.—13s. March ; 14s. April ; 15s. May ; 16s. to 18s., June—Crop over ; 20s. July and August. New crop started in August with a demand for Canada ; 18s. in beginning of September, dropping to 15s. by end of the month ; 12s. 6d. to 12s. in October ; and 12s. 6d. and 13s. during November and December.
Orange, Sweet	<i>Citrus Aurantium</i>	16s. to 18s. per 100 lbs. January to March ; 18s. 6d. to 20s. March to beginning of May when the Southside crop comes in and lasts to about end of June ; July 18s. full crop in August, 18s. 6d. ; September 18s. 6d. dropping to 14s. 6d. at end of month ; October 13s. 6d. to 16s. 6d. ; November 15s. 6d. : December 15s.
Pimento	<i>Pimenta officinalis</i>	Sticks, $\frac{3}{4}$ inch to 1 $\frac{1}{4}$ inch, diameter, 8s. to 10s. per 100.
Pimento sticks and clubs	<i>Pimenta officinalis</i>	Clubs, 3 inches to 6 inches, diameter, 4s. to 8s. per dozen. Both in good demand.
Pine-apple (Bull-head)	<i>Ananas sativa</i> var.	January to early part of March, 3s. per doz. ; 4s. in April ; 2s. to 3s. per doz. from April to August. No trade from end of August.
Pine-apple (Ripleys)	<i>Ananas sativa</i> var.	During March, 4s. to 7s. per dozen ; April, to end of June, 6s. per dozen, July, 5s. per dozen, August, 4s. per dozen.
Sarsaparilla	<i>Smilax papyracea</i>	4d. to 4 $\frac{1}{2}$ d. per lb. from January to end of August. The real crop time is from January to end of June.

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APRIL, 1906.

Part 4.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.,

Director of Public Gardens and Plantations.

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P R I C E—Threepence.

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BULLETIN

OF THE

DEPARTMENT OF AGRICULTURE.

Vol. IV.

APRIL, 1906.

Part 4.

CASSAVA TRIALS III.

FINAL RESULTS OF TEST OF 23 VARIETIES.

By H. H. COUSINS, M.A., Oxon., F.C.S., Island Chemist.

The results obtained in this series of trials at the Hope Experiment Station of Cassavas at 12 and 15 months' growth have been given in this Bulletin (1905 pp. 152-155 and 218-219) and the final results of the tonnage and starch yield per acre after 21 months' growth have now been obtained.

Tables are given showing the results of the final yield, the comparative yields of tubers and of starch at 12, 15 and 21 months' growth, and finally of the increased yield of tubers and of starch by prolonging growth from 12-15 months and 15 to 21 months respectively.

Best varieties for harvesting at 12 months.

'White Top' proved the best variety in these experiments with a yield of 10.5 tons tubers containing 7,902lbs. starch per acre. Next came 'Long Leaf Blue Bud' with 9.0 tons tubers followed by 'Blue Top' with 8½ tons per acre. 'Smalling' was fourth, closely followed by 'Rodney' and 'Luana Sweet.'

Best varieties for harvesting at 15 months.

'White Top' fell off after 12 months' growth and is clearly a variety that does not improve by a longer period of growth than a year. At 15 months, 'Long Leaf Blue Bud' proved to be the most prolific variety, yielding 15.4 tons of tubers with 4,955lbs. starch per acre. 'Smalling,' 'Mullings' and 'Luana Bitter' followed in the order named.

Best varieties at 21 months.

'Blue Top' is the champion cassava of this series having given us 21.9 tons of tubers and over 7 tons of starch per acre (15,818 lbs). This result would have been considered fabulous previous to this careful series of field trials, and it is claimed that we have now proved that cassava can be grown without irrigation in the plain of Liguanea in Jamaica to give a yield of starch greater than has ever been recorded before of any starch-producing plant.

It is true that this crop has taken the plant practically two years to produce, but when we remember the cheapness of land

and the low cost of cultivation involved in the prolonged period of growth, it is abundantly clear that the cost of increasing the starch yield from $3\frac{1}{2}$ to 7 tons per acre is out of all proportion to the value of the increased product.

It would appear therefore, that the most economic production of starch would be attained by the cultivation of such a variety as 'Blue Top' upon a biennial basis.

For quick returns 'White Top' would be the better variety and in starting a starch factory it would be advisable to grow half the cassava area as an annual and half as a biennial crop.

The variety 'Black Stick' has steadily improved during the second year of growth and now holds second place in starch production with the record percentage of 38.2 per cent. of starch in the tubers and an indicated yield of nearly 7 tons starch per acre. 'Smalling,' although giving a bigger tonnage of tubers than 'Black Stick' stands decidedly below that variety in starch yield. "Mullings" comes fourth with a little less than 6 tons starch per acre, while 'Long Leaf Blue Bud' that led at 15 months has not since gained at all in yield of tubers and shows only a very small increase in starch per acre as the result of the further 6 months' growth.

Clearly, this is a variety that is at its best at 15 months, and one that it would not pay to grow as a 21 months cassava in competition with the other varieties.

Percentage of starch in the tubers.—At 12 months' 'Luana Sweet' had the highest content of starch (35.2 per cent.), at 15 months, 'Long Leaf Blue Bud' heads the list with 37.4 per cent., while at 12 months' growth this variety is very slightly inferior to 'Black Stick,' which leads with 38.2 per cent. of starch in the tubers.

The recorded maximum starch content for a Jamaican Cassava is 39.1 per cent. for the variety 'White Smooth Bitter' grown by the Hon. T. H. Sharp at Inverness in Clarendon in 1903.

This variety as grown at Hope only attained a content of 35.5 per cent. of starch.

These experiments emphasize the fact that Cassava varieties are so variable in their yield under different conditions of soil and locality that it is most desirable to carry out careful tests of a selected series before the best varieties for any given place and purpose can be correctly ascertained.

Not only is there a great variation in the yield of tubers, but also of starch content and period of growth.

Conclusions.

1. Under conditions obtaining at Hope and without irrigation a yield of $10\frac{1}{2}$ tons tubers at 12 months, of $15\frac{1}{2}$ tons at 15 months and of nearly 22 tons tubers per acre at 21 months has been recorded.

2. The indicated yield of starch per acre has risen from $3\frac{1}{2}$ tons at 12 months to $5\frac{1}{2}$ tons at 15 months, and $7\frac{1}{2}$ tons starch at 21 months' growth.

3. This yield has been obtained at a cost of about £5 per acre and it is abundantly clear that we can produce enormous crops of

cassava in Jamaica at a cost that should enable us entirely to replace Potato starch in the British market.

4. Cassava can be grown to give a large yield upon a soil and with a rainfall that would not give good crops of sugar cane without irrigation. Large areas of land, at present producing little or nothing, could be profitably used for the growth of cassava for starch manufacture. This is an industry that can be confidently recommended to capitalists and land owners as one of the most promising means of increasing our exportable produce without trenching upon land at present productive of other paying crops.

I desire to acknowledge the work of Mr. F. A. Thompson of this Department in analysing the tubers and the careful way in which the Superintendent at Hope Gardens recorded these results in the field.

Cassava Trials III.

(Twenty-one varieties harvested after 21 months growth.)

Order of starch yield.	Variety.	Tubers	Moisture.	Total solids.	Sugars.	Starch.	Starch per acre lbs.	Gain per acre from 15 to 21 months.	
		Tons per acre.						Tubers (tons)	Starch, lbs.
1	Blue Top .	21.9	61.9	38.1	1.8	33.2	15,818	7.7	6,085
2	Black Stick .	18.0	58.3	41.7	1.6	38.2	15,433	11.5	10,236
3	Smalling .	19.3	59.2	40.8	0.9	32.0	13,883	8.2	5,330
4	Mullings .	18.0	64.4	35.6	1.1	32.8	13,277	6.9	5,097
5	Long Leaf Blue Bud.	15.4	55.9	44.1	1.0	38.0	13,187	..	330
6	Duff House .	15.4	60.2	39.8	1.4	36.4	12,632	4.8	5,034
7	Prize or Silver Stick.	12.9	58.0	42.0	1.5	36.9	10,666	7.8	6,622
8	White Smooth Bitter.	12.9	57.0	43.0	1.1	34.3	9,920	3.5	2,485
9	White Stick .	11.6	54.8	45.2	1.8	37.3	9,742	7.7	6,615
10	Brown Stick .	11.6	58.5	41.5	1.3	34.2	8,927	..	1,522
11	Black Bunch of Keys	11.6	60.3	39.7	1.4	34.1	8,894	5.1	4,308
12	White Top .	11.6	60.8	39.2	0.9	33.5	8,753	0.6	1,115
13	Silver Stick .	10.3	58.3	41.7	1.4	37.1	8,574	3.8	3,974
14	Bobby Hanson .	10.3	56.1	40.9	1.1	35.5	8,197	1.9	2,063
15	Black Bitter Long Leaf								
	Blue Bud .	9.0	55.3	44.7	1.0	37.4	7,567	2.1	2,374
16	White Bunch of Keys	9.0	57.6	42.4	1.5	36.9	7,466	2.5	2,560
17	Cotton Tree .	9.0	55.5	44.5	0.9	36.7	7,221	..	..
18	Luana Sweet .	9.0	61.3	38.7	1.5	35.1	7,102	0.9	562
19	New Green .	11.6	64.4	35.6	1.3	26.4	6,895	5.1	38,08
20	Rodney .	10.3	65.9	34.1	1.7	28.3	6,547	0.6	384
21	Luana Bitter .	9.6	64.9	35.1	1.5	29.7	6,425	0.2	1,261
									Loss

Comparative yields at different stages.

No.	Variety.	Tons per acre.			Lbs. Starch per acre.		
		12 m'nths	15 m'nths	21 m'nths	12 m'nths	15 m'nths	21 m'nths
1	Blue Top	8.25	14.2	21.9	5,636	9,733	15,818
2	Black Stick	6.5	6.5	18.0	4,878	5,197	15,433
3	Smalling	7.5	11.1	19.3	5,494	8,553	13,883
4	Mullings	5.75	11.1	18.0	4,160	8,180	13,277
5	Long Leaf Blue Bud	9.0	15.4	15.4	6,552	12,857	13,187
6	Duff House	5.5	10.6	15.4	4,107	7,598	12,632
7	Prize or Silver Stick	3.5	5.1	12.9	2,634	4,044	10,666
8	White Smooth Bitter	3.25	9.4	12.9	2,460	7,435	9,920
9	White Stick	3.25	3.9	11.6	2,522	3,127	9,742
10	Brown Stick	3.25	11.6	11.6	2,384	7,405	8,927
11	Black Bunch of Keys	3.25	6.5	11.6	2,388	4,586	8,894
12	White Top	10.5	11.0	11.6	7,902	7,638	8,753
13	Silver Stick	3.5	6.5	10.3	2,744	4,600	8,574
14	Bobby Hanson	6.25	8.4	10.3	4,777	6,134	8,197
15	Black Bitter Long Leaf Blue Bud	6.00	6.9	9.0	4,462	5,193	7,567
16	White Bunch of Keys	5.25	6.5	9.0	4,069	4,906	7,466
17	Cotton Tree	...	...	9.0	...	...	7,221
18	Luana Sweet	6.75	8.1	9.0	5,322	6,540	7,102
19	New Green	5.25	6.5	11.6	3,192	3,086	6,895
20	Rodney	7.5	9.7	10.3	5,337	6,931	6,547
21	Luana Bitter	4.25	9.4	9.6	3,075	7,686	6,425
22	Mass Jack	4.25	5.1	...	3,091	3,243	...
23	Yellow Belly	3.5	3.2	...	2,321	1,921	...

INCREASE.

No.	Variety.	Tons tubers per a.		lbs. starch per acre	
		12-15 months.	15-21 months.	12-15 months.	15-21 months.
1	Blue Top	6.0	7.7	4,097	6,085
2	Black Stick	...	11.5	319	10,236
3	Smalling	3.6	8.2	3,059	5,330
4	Mullings	5.3	6.9	4,020	5,097
5	Long Leaf Blue Bud	6.4	...	4,955	330
6	Duff House	5.1	4.8	3,491	5,034
7	Prize or Silver Stick	1.6	7.8	1,410	6,622
8	White Smooth Bitter	6.1	3.5	4,975	2,185
9	White Stick	0.6	7.7	605	6,615
10	Brown Stick	8.3	...	5,021	1,522
11	Black Bunch of Keys	3.2	5.1	2,198	4,308
12	White Top	0.5	0.6	264	1,115
				Loss	
13	Silver Stick	3.0	3.8	1,855	3,974
14	Bobby Hanson	2.1	1.9	1,357	2,063
15	Black Bitter Long Leaf Blue Bud	0.9	2.1	731	2,374
16	White Bunch of Keys	1.2	2.5	837	2,560
17	Cotton Tree	...	...	...	...
18	Luana Sweet	0.3	0.9	1,218	562
19	New Green	1.2	5.1	106	3,809
				Loss	
20	Rodney	2.2	0.6	1,594	384
				Loss	
21	Luana Bitter	5.1	0.2	4,611	1,261
				Loss	
22	Mass Jack	0.8	...	152	...
23	Yellow Belly	0.3	...	400	...
		Loss		Loss	

COTTON DISEASE.

From Commissioner, Imperial Department of Agriculture, to Director of Public Gardens.

Imperial Department of Agriculture for the West Indies,
Barbados, January 23, 1906.

My dear Fawcett,

I am in receipt of your letter of the 8th instant advising the sending of some bolls from Mr. DeMercado's cotton in Vere apparently attacked by anthracnose.

I enclose for your information a report prepared by Mr. Stockdale on the samples sent.

With kind wishes,

Very sincerely yours,

(Sgd.) D. MORRIS.

Imperial Commissioner,

The four cotton bolls forwarded by Mr. Fawcett from Mr. De Mercado's estate in Vere are small and ill-shaped. Two of these show the characteristic spots of anthracnose, from which spores of *Colletotrichum gossypii* are given off. These spores appear to be of a greater diameter than those described by Mr. Lewton-Brain (W. l. B., Vol. V., p. 191) as *Colletotrichum gossypii* var. *barbadense*, and I should be pleased if Mr. Fawcett could obtain further specimens, so that this difference might be looked into more fully.

The spots of anthracnose on these two bolls were over-grown with *Fusarium* which is probably saprophytic (West Indian Bulletin. Vol. V., p. 178). The other two bolls show no signs of anthracnose, but appear to have been dried up through some purely physiological causes and have subsequently become covered with *Fusarium*. I have seen many such examples in Barbados this year, more frequently immediately after changes of weather when the plant does not seem able to support or properly feed a large number of bolls.

Suggested Remedial Measures—The fungus that causes the Anthracnose spreads by means of spores which are disseminated by wind and insects and is capable of growth on all parts of the plant. If the area is badly attacked it would be advisable to destroy all diseased plants and parts of plants and not to set cotton in the infected area for a few years.

If a young crop of cotton is badly infected, spraying with Bordeaux mixture would probably prevent the germination of spores and so prevent further infection of bolls. This must not be done if any of the bolls are matured, as the solution of copper salts would seriously discolour the lint and therefore reduce its value. If the crop of cotton is advanced and the disease is doing serious damage, experiments with dry fungicides might be conducted, say

with a mixture of sulphur and lime (the lime being in excess of the sulphur).

This mixture can easily be made and can readily be applied. The slowly-evolved gases, are readily soluble in water, forming a solution which should be strong enough to kill the spores and germinal tubes, but too weak to injure the leaves of the plant. I have been unable to obtain any information respecting any experiments that have been carried on either in America or the West Indies with a view to obtaining a treatment for the prevention of anthracnose of cotton, and therefore this makes it all the more important that experiments should be started even on a small scale, to obtain such information.

Another point in the treatment of this disease is very important—this is the sterilization of cotton seed before planting. Spores are held attached to the seed coat and these possibly produce the disease in the cotyledons of seedlings. Further information on the sterilization of cotton seed will be forthcoming before next planting season as experiments are now in hand dealing with this subject.

F. A. STOCKDALE, Mycologist.

LOGWOOD : DISEASE AND CULTIVATION.

In the fall of the year 1902 the Director of Public Gardens went on special leave to the States. He was fortunate enough to interest Dr. Britton, Director of the New York Botanical Garden, in Jamaica, and on his return Dr. Britton allowed Prof. Earle to accompany him to study generally the plant diseases of the Island. Prof. Earle made a report which was published in the Jamaica Bulletin for February, 1903. One of the diseases investigated was the Logwood Root Rot, and the following is Prof. Earle's statement about it. Recently letters have appeared in the "Gleaner" from Dr. Bucher and Mr. J. W. Edwards on the subject, and it has been thought well to call the attention of planters again to the subject.

I. BY PROF. EARLE.

On some estates, especially toward the western end of the island, logwood trees are dying in considerable numbers.

The diseased trees usually occur in groups, the infection spreading slowly but in constantly widening circle. An examination of dying trees shows the roots to be badly rotted. Their surface tissues are invaded by a white fungus mycelium that is usually more abundantly developed in the region between the bark and the wood. The disease seems to attack first the small rootlets, gradually spreading to the larger roots and the crown when the tree dies. In many cases seeming healthy trees near the border of infested areas were found to have the roots on the side next the dying trees badly diseased, while on the other side they were still perfectly healthy. The fungus seems to be the mycelium of some of the Hymenomycetes. Numerous species of Polyporaceae

and Thelophoraceae were taken on logwood stumps and logs, but in no case could their connection with this root rot be satisfactorily proven. Whatever the nature of the fungus, leaving stumps of trees that have died from this disease in the neighbourhood of living trees is clearly dangerous. Dying trees should be dug and the roots burned as soon as the disease can be detected. Where it is confined to certain small definite areas as is often the case, it would be advisable to dig a trench three feet deep just outside of the diseased area in order to prevent its spread underground to the roots of healthy trees. On a few of the estates examined the disease was so widely scattered that this method of treatment would not be practicable. Here it would seem best to clear the infested tract entirely of logwood, marketing such as was sufficiently mature, and allowing the land to grow up in pimento and limes, or reserving it for pasturage or cultivation. It should be mentioned in this connection that pimento trees are said to die from a similar root rot in some parts of the island. If this should prove to be identical with the logwood root rot, pimento would not be available as an alternative crop.

This root rot seems to spread slowly. One old logwood chipper assured me that trees had been dying for thirty-five years on a spot that he pointed out. This area does not now include over three or four acres. This would indicate that by vigorous measures it could be controlled. The disease was found on various kinds of soils and under moisture conditions varying from dry rocky hill sides to the margin of swamps. In some cases the diseased areas were on spots where the soil was rich and deep and the moisture and drainage condition perfect. It was not observed on the heavy clay lands towards the eastern end of the island but whether this was due to the absence of infection or to the character of the soil could not be determined.

II. BY DR. E. BUCHER.

In driving through Westmoreland one cannot but notice that the logwood blight investigated some time ago by Prof. Earle of the New York Botanical Garden* is rapidly spreading. Too many pastures look as if the logwood trees, young and old, had been singed by fire from the top downwards. Prof. Earle pronounced the blight to be a contagious root disease. If not attended to, it will do serious damage to the logwood industry in that part of the island.

Logwood growers will do well to remember the disastrous experience of European wine growers with phylloxera. That insect pest appeared to be harmless enough at first, until it spread so fast that it was hopeless to cope with it. The best vineyards of France were laid bare. Those who had thought themselves to be the wealthiest cultivators suddenly found themselves to be almost

* Now Director of the Agricultural Experiment Station, Cuba. *Editor.*

beggars. Utter ruin was only averted by making a fresh start, pulling out every vine stock and replanting the vineyards with the hardier American plant.

A logwood grower who sees the disease appear on his property owes it not only to himself but also to his neighbours to eradicate the disease as it appears and prevent its spread. If any one doubts that this can be done successfully let him pay a visit to that model logwood property, Old Hope. There he will look in vain for a dead logwood tree. Mr. J. W. Edwards, the attorney, will perhaps be good enough to tell us by what means he has managed to keep Old Hope free from the disease. We will be thankful to him if he will give us the information.

III. By J. W. EDWARDS.

With reference to Dr. Bucher's letter, I am bound to admit that the remarks about the logwood generally in Westmoreland are only too correct.

I took Prof. Earle, when he was in the country three years ago, to Old Hope.

The Professor went to considerable trouble to inspect the trees at different positions on the property that showed signs of the disease and after most minute investigation he pronounced it a root disease that was highly contagious.

Acting on his advice I have from that time cut down and burnt wherever practicable, any trees showing the slightest trace of the disease, with satisfactory results.

As Dr. Bucher who is such an eminent authority on logwood, thinks that Old Hope is in a fair state of cultivation, it may interest logwood growers to show the system that has been pursued at this property.

The growth of young saplings is encouraged every year with the view of having rotation crops.

Saplings are grown thickly in order to induce the growth of long straight trunks, but after a time the useless ones are thinned out to give light and air to the most promising ones.

On no account are any saplings allowed to be trimmed of the prickles which are evidently given them by nature to protect them from stock, and when the trunks are sufficiently strong to resist pressure from animals in rubbing against them, the prickles disappear naturally, the trunks then presenting a nice clean smooth bark.

If after the trunks are naturally cleaned off, it is thought that too many limbs are thrown out some of the lower ones should be cut off with an *upward cut* to prevent soakage by water.

The shippers are never allowed to rest their wood against other trees, in order to preserve the bark from injury by chafing.

Another matter that receives attention is the killing of duck ants' nests, which are so frequently seen on trees; this is done by arsenic sweetened with molasses, or sugar.

EARLY ORANGES.

24th January, 1906.

The Governor directs* the publication, for general information, of the following letter from the Director of Public Gardens and Plantations, containing suggestions for promoting the earlier ripening of oranges.

By command,

H. CLARENCE BOURNE,
Colonial Secretary.

Department of Public Gardens and Plantations.

Hope Gardens, Kingston, P.O.,
12th January, 1906.

SIR,

I have the honour to acknowledge your letter No. 11002/13504, dated 14th ultimo with reference to the controversy on the shipment of unripe oranges, and asking me to consider whether it is feasible to cause oranges to ripen earlier.

2. There are two classes of oranges exported viz.: the fruit of seedling trees, and that of budded trees, of which the number exported of the former is enormously in excess of the latter. The problem therefore refers chiefly to the fruit of seedling trees.

3. Budding trees from early varieties can to some extent and after a considerable time, bring in early fruit: these trees will also be affected by any solution of the general problem.

4. To the peasantry, who own the vast majority of the trees, I would offer the following suggestions. Early fruit is encouraged by:—

- (1) removal of all fruit late in October or early in November,
- (2) removal at the same time from the trees of all dead wood, lichens, moss, and other growths,—this of course should be also done throughout the year.
- (3) opening up the main roots for a foot or 18 inches from the stem, and removing the soil from them.
- (4) application of lime on surface of ground from stem as far as branches extend,—all the above work to be finished during November.
- (5) forking up the soil in December for a breadth of a foot all around the tree just outside the extremities of the root-system, and application of woodashes, bones and a little well-rotted pen manure to it, or the equivalent in commercial fertilisers.
- (6) maintaining a mulch of grass, &c., from January until the fruit is full and then removing it.

* Jamaica Gazette, 25th January, 1906.

(7) irrigating, whenever possible, by using waste water, &c., during the same months that the mulch is used.

(8) thinning out the fruit by one half when they are about the size of marbles.

5. I believe that these cultural operations would have a decided effect in bringing in earlier fruit, and would be well worth the expense.

I have, etc.,

W. FAWCETT, Director.

The Hon. The Colonial Secretary.

The following letter on the same subject is reprinted from the "Gleaner" of the 12th February.

The Director of Public Gardens and Plantations to the Editor of the "Gleaner."

Hope Gardens, 9th February, 1906.

SIR,

Mr. T. H. Sharp's letter on producing early fruit in the orange is interesting and suggestive.

His statement that "the trees have two energies: the energy of reproduction and the energy of growth" is correct, and the theory and its practical applications have been treated at some length in the *Bulletin* for February, 1904, in which it is shown that "a decrease in nutrition during the period of growth favours the development of the reproductive parts while abridging the vegetative parts."

The consideration of this fact in the economy of plant life was not omitted in the letter to the Colonial Secretary, but the method suggested is that used by nature herself, checking or preventing nutrition, rather than injuring and half-killing the tree, as Mr. Sharp proposes, by "smashing the outer bark as well as the cambium" of the trunk near the ground by blows from a mallet.

Under natural conditions plants undergo a decrease of nutrition from various causes: two of these causes,—drought, and in some plants, the fall of the leaf, e.g., in our "common cedar," are readily recognized by every one as natural checks to growth.

The fall of the leaf prevents the chemical union of the mineral constituents taken up by the roots with the carbon extracted from the carbonic acid of the air,—which chemical change takes place in the leaf, forming the food of the living organism.

The check by drought to the absorption of food materials by the roots is much more serious, if it is thorough, and if it lasts long enough.

In treating the orange we cannot cut off its leaves, but we can interfere with the action of its roots. We cannot prevent rain falling, but we can do something to prevent absorption by the roots, and so imitate drought.

The removal of the soil from the roots was suggested for 12 to 18 inches from the stem; if that is not sufficient to stop growth, I would remove the soil to a greater extent, but then comes in the question of expense and whether it would pay to do so.

Forking round the extremities of the root system was also suggested; this should be done in such a way that the roots would be carefully cut back, so limiting root action.

These two methods of checking nutrition are not only effective for that purpose, but they conduce to greater vigour.

Opening up the main portion of the roots near the stem aerates and dries the soil all round, checks any tendency to foot-rot, and prevents attacks there by grubs. Shortening back the roots leads later on to extensive branching and development of the roots, especially as the ground has been loosened in the direction of growth.

I am, etc.,

W. FAWCETT.

Dr. Tillman has kindly contributed the following account of the methods adopted in his Orange Grove, which is a model for cultivators.

Dr. Tillman to the Director of Public Gardens.

Camden Grove, Race Course, P.O. Jamaica,
10th March, 1906.

Dear Sir,

In reply to yours of the 28th December, I beg to enclose herewith, a/c sales of fruit sold in December; and you will see that the prices range from 8/ to 9/ per box. It cost 6/ to place a box of oranges on the market, including everything—capital paying prices for that time of year.

During August I got 15/ to 16/; September, 14/ and 14/3; October, 11/ to 12/, and November, 10/ to 11/. You must pardon my not answering before, as I had to wait for the last a/c sales, and they did not come to me until end of last month.

Re my efforts to obtain early fruit: Immediately after the October seasons will permit, I pick off all fruit, say early in November, and start ploughing with two pony ploughs, up and down each side of the intervals, between the trees; making three cuts on each side, about three inches deep—the first cut being made directly under the extreme end of the outside of the lateral branches.

The same cuts are made by the other plough, the other way of the interval, so that the fine terminals of the surface roots are sliced through on each of the four sides of the trees that is pruned. The whole interval is not ploughed or close ploughed, for the reason that I would not be able to do the whole 32 acres quickly enough.

As soon as each interval has had three cuts made both sides, all over the cultivation, then the ploughs are allowed to plough

thoroughly the whole field. The ploughing is so done that each cut of the plough throws the earth towards the tree, so as to protect the cut ends of the roots with the fine dirt thrown by the next cut. The ploughs have new socks every six days to ensure clean and deep cutting when the above work is being done (ordinarily only every fourteen days are they changed).

The trees are in the meantime gone over with a gang of women under two headmen; all infested leaves that are bad are cut off with the scissors, and those with scale insect scrubbed by hand with small pieces of bagging dipped in warm soap or kerosene emulsion—branches also scrubbed.

All the inner branches and twigs that prevent light and air from going freely through the tree, are pruned away to throw all the energy for blossoming into the terminal branches. No water is allowed near the trees for fully six weeks—that is, the whole of November and part of December. Water is then applied, say about the second week in December, and the trees thoroughly flooded, the cultivator being passed over two days after, to save the earth drying and cracking and conserving the moisture below the surface.

Pruning roots and branches and cleaning the trees coupled with the rest that the trees get for the six weeks while suffering for want of water, compel a large number of the trees to commence to blossom about three weeks after the first application of water, and from then, each watering (three weeks apart), brings out more blossoms; so that blossoms first appear during the first week in January. This year fully a thousand trees commenced to bloom during the first ten days of January; of course in the majority of cases, only partially.

I have had quite a few trees that I picked fruit from as late as the middle of November, bloom in January slightly, but of course the trees that had been relieved of fruit earlier than November, bloomed earlier and heavier.

This coming season I do not intend to pick any fruit in November; so that I will have all fruit shipped by end of October. All blossoms after the 15th March will be picked off so as to save the trees carrying late fruit needlessly and thus ensuring an early bloom next season.

The above method can only be adopted in the irrigated districts of Vere and St. Catherine, as only with irrigation can the trees be controlled in a great measure; and as you are aware, there are barely half a dozen groves altogether in the two parishes named; but I am certain that a great deal of good could be effected in the hills where practically, all the fruit comes from, if the trees were treated as you recommend them to be. Of course the trees in the hills are entirely at the mercy of the seasonal rains and would not, even with irrigation, bloom very early in the year owing to the climatic conditions.

Even at the present time of writing, many of the wild trees are loaded with over-ripe and unmarketable fruit, thus perpetuating a lot of the mischief and compelling the sending away of immature

fruit in August and September, the trees not blossoming until April; in consequence, our fruit continues to have such a bad name in the market.

A very important fact also must not be lost sight of, and that is, that the fruit grown in the lowlands only take from seven to seven and a half months to mature, whereas fruit in the hills take from eight to nine months.

Hoping the above will prove that not only can fruit be grown in the irrigated lowlands, but what is more important still, that groves established and properly cultivated, can be made to produce early ripe oranges to supply the best market. That would give Jamaica an unrivalled position as a citrus fruit centre. Florida California, and the Mediterranean, owing to the climatic conditions, would never be able to supply mature fruit in the months of August and September.

Cuban groves under go-ahead American management, with irrigation, would be our only competitors. I will with great pleasure give all the facts and figures after the coming season to the public as I feel sure there is a great future before the industry on these lines.

Yours faithfully,

(Sgd.)

HARRY G. TILLMAN.

FORWARDING DISEASED PLANTS AND INSECT PESTS.*

Much disappointment has lately been experienced, both by the sender and also by the receiver, through plants, supposed to be diseased, and insect pests reaching the laboratories of the Imperial Department of Agriculture in an unfit condition for scientific examination. It is hoped that officers of the department and others will carefully study and follow the suggestions that have been given by the Department on former occasions. (See *Agricultural News*, Vol. I, p. 243, and Vol. II, p. 235.) The chief reasons for this state of things are one or more of the following:—

(1) The fragmentary nature of the material sent for investigation. (2) Lack of care in transmitting, the specimens arriving shrivelled or dead or mouldy. (3) Absence of information as to the conditions under which the plants grew.

It must be pointed out that a few fragments of a diseased plant are of little use for investigation, and sufficient material should be sent so that the primary cause of the trouble may be located.

In order that time and labour may not be wasted in the examination of unsuitable material, care must be taken in collecting and packing specimens so that they may arrive at Barbados in good condition. Fresh specimens of moist vegetable matter should not be sent packed in boxes or in envelopes, but should be either suitably dried and sent in a well-ventilated package or, preferably

* Reprinted from the *Agricultural News*, Vol. IV., p. 366.

placed in spirit immediately after collection and forwarded in a bottle or corked tube. Care must be taken with the strength of the spirit used. A 30-per cent. spirit is quite sufficient to act as a preservative, and this can easily be obtained by taking distilled rum and adding two parts of water to one of the rum. If material is sent in undiluted spirit or high wines, it becomes so hard and brittle that examination is exceedingly difficult.

When leaves, buds, or twigs are attacked, the specimens should show as many stages of the disease as possible. Detached leaves alone are, as a rule, useless. If practicable, the root, after the soil has been shaken off, should be sent, as in many instances, the primary cause of the trouble is located there.

When fruits or herbaceous stems are attacked, pieces showing all stages of the disease, should be placed in spirit as before. When it is thought desirable to send very large specimens, such as portions of branches, roots, or whole cacao pods, these should be collected as late as possible before the mail steamer leaves and sent in a well ventilated case.

Full particulars should also be forwarded, giving details of the time of appearance of the disease, the damage done, the part attacked, the nature of the soil, drainage, and also whether an apparently similar kind of disease had been previously observed.

With regard to the forwarding of insects for examination, directions have already been given in the *Agricultural News* (Vol. IV. p. 168), but on account of the repeated disappointment resulting from material being badly packed the following detailed instructions have been prepared :

Insect material for transmission must be packed in such a way (1) that it will not be broken, bruised, or crushed, and (2) that it will not be spoiled by the growth of moulds, mildew, or bacteria.

In considering the manner of forwarding insects, these may be divided roughly into these three groups : (1) Larvae that is, grubs, maggots, caterpillars, including borers, etc. (2) Hard insects, such as beetles, bugs, grass-hoppers, crickets, bees and wasps. (Scale insects may be included in this group.) (3) Frail insects, such as butterflies, moths, flies, etc.

In packing for transportation the following rules apply to these groups :—

Group I.—When sent alive, larvae should be packed with a supply of the food plants on which they have been found feeding or in the plant material they infest, in such way that they should not be rattled about in the package or crushed by portions of the food plant, etc. When not sent alive they should be preserved in a tightly-corked tube or vial in diluted spirit or formalin.

Group II.—When sent alive these insects should be provided with food, as for instance, in the case of lady-birds, leaves and twigs infested with the plant lice or scale insects on which they feed should be included and packed in such a way that they cannot rattle about in the box. Footholds, such as crumpled pieces of blotting paper, should be given the insects also. When not sent alive insects of this group should be dried and wrapped loose

ly in soft tissue-paper, each insect in a separate paper, and then packed in a strong box. In the case of scale insects, each infested leaf and twig should be folded or wrapped in soft paper and dried before being enclosed in a tight package.

Group III.—Insects of this group should be killed and handled carefully to prevent injury, folded or wrapped in paper and well dried before being packed. Butterflies, with their wings folded together, may be folded in paper, moths may be wrapped loosely in tissue paper, and flies may be included in layers of tissue paper between cotton wool, in small boxes.

Full notes should accompany all insect specimens, stating the nature of the damage done, the part of the plant attacked where insects were found, and whether larva or adult does the damage; if the larva, a specimen of the adult should be included also, if possible. Notes on their habits such as whether night feeder or day feeder, where eggs are laid, etc., should in every case be added so far as known.

Disappointment is most likely to result from (1) insufficient material, (2) insufficient notes and information as to habits, etc., (3) bad packing which allows specimens to be crushed or to decay in transportation, and (4) from sending specimens so broken and battered that it is impossible to identify them.

THE COCO DE MER, OR DOUBLE COCONUT.

Several "double coco-nuts" were received from the Commissioner of the Seychelles Islands in 1896. There is one plant now growing in the Hope Gardens close to the Casuarina tree on the other side of the stream, and a plant also in Castleton Garden.

They grow very slowly, no stem being yet seen above ground; the height of the top of the largest leaf is $10\frac{1}{2}$ feet. A nut which failed to germinate may be seen on application at Hope Gardens, and another at Castleton Garden.

The history and the structure of this palm are of such an interesting nature that the following articles on it are reprinted.

I. By GEORGE V. NASH.*

In the Indian Ocean several hundreds of miles to the eastward of Zanzibar, and about four degrees south of the equator, is a group of islands known as the Seychelles. These were discovered by the Portuguese as early as 1505; were occupied by the French in 1743; seized by the British in 1794, and formally ceded to them in 1814. Here at the time of the French occupation in 1743 was discovered a beautiful palm, the fruit of which had been known for many years, but the origin of which had been one of the mysteries of those early times. As in those times mysteries always give rise to most fabulous tales, so was it with this unknown fruit, which, on account of its obscurity, was accredited with most

*Journal of the New York Botanical Garden, January, 1906, p. 7.

wonderful properties and given a worth far in excess of its intrinsic value. It was known as *coco de mer*, *coco de Solomon*, and *coco des Maldives*, this last name being applied because so many of these nuts had been found floating in the sea near the Maldivé Islands. It was averred by these ancient people that it was not a product of the earth but of the sea, and the Malay and Chinese sailors insisted that it grew on a tree deep in the water off the coast of Sumatra, but that the tree instantly disappeared when they dived down to see it. The negro priests were firm in the belief that it grew near the island of Java, its branches protruding above the water, and that here a monstrous bird had its home, from which it made nightly sorties to the land, killing tigers, elephants and other large animals; they further asserted that ships were attracted by the waves which surrounded the tree, an attraction from which there was no escape, and that the sailors fell an easy prey to this voracious bird. One can well understand with what care the poor superstitious sailors of the Indian Archipelago must have avoided this spot.

Not only did these tales serve to bring the fruit into notice, but its reputed value as an antidote to poisons made its acquisition greatly to be desired by the princes of Hindostan, who, prone to use such poisons on others, were constantly in fear of being made victims themselves of some wily poisoner.

It is not strange that they were willing to pay large sums for these mysterious objects which would protect them from their enemies. They firmly believed that water which had been kept in one of these was purified from all harm, and could be drunk with impunity, no matter how active may have been the poison placed in the liquid. The sovereign of the Maldives was not long in turning this to his own advantage as a means of increasing his wealth, for he made it a matter of death for any one to have in his possession one of these nuts—all were his property, which he disposed of at a high price or used in making royal presents. But in 1743, upon the discovery of the tree which bore these fruits, this value and repute quickly subsided, for, so they must have reasoned, where there is no mystery how can there be any virtue.

One of the earlier accounts of this palm occurs in a book of voyages published in 1776 in Paris.* A plate illustrating the Seychelles themselves and several other plates depicting features of the palm and its fruit are given. It is there stated that many of these palms grow near the shore of the sea, most of the fruit of such trees dropping into the sea and floating upon its surface. The winds waft them, and the currents, the direction of which in those parts is E.N.E., carry them to the shores of the Maldives, the only part of the world where these fruits had been known previous to the discovery of their origin on the Seychelles.

The palm grows upon three of the islands of the Seychelles, occurring in all parts of them, the best trees growing in deep gorges. One such gorge on the island of Praslin is known as the Ravine

* *Voyage a la Nouvelle Guinee par M. Sonnerat. Paris. 1776.*

of the Coco de Mer, and is said to be one of the most beautiful spots in tropical climes, the trunks of these charming palms rising to a height of ninety or a hundred feet and bearing aloft a crown of magnificent fan-shaped leaves, often twenty feet long and ten or twelve feet wide.

The many economic uses of this palm make it of exceeding value to the natives of the Seychelles. The heart of the crown of leaves is eaten as a vegetable, as is done with the cabbage palm. The leaves, perhaps, are the most important, being used extensively in house-building, not only for thatching, but also for making walls and partitions; and the down of the young leaves is used in filling mattresses and pillows. The nuts are made into utensils of various kinds, and the young leaves furnish material for making hats.

II.*

On the Double Cocoa-nut of the Seychelles (Lodoicea Sechellarum) "Sea Cocoa-nut," "Double Coconut," "Coco de mer."

By SWINBURNE WARD, ESQ., Civil Commissioner, communicated by Sir W. J. Hooker, F.R.S., & L.S., &c.

This extraordinary specimen of the palm tribe, the largest and most curious of all the many varied kinds scattered over all tropical regions, is found only in two small islands belonging to the Seychelles group, "Praslin" and "Curieuse," which lie in juxtaposition between 4° and 5° of S. lat., and 55° and 56° E. long.,—nearly three hundred miles north-east of Madagascar, which, though itself an island, may, from its immense size, be legitimately considered the nearest mainland.

The name by which it is best known, that of "Coco de mer," was given to it by some French navigators who had picked up the nut floating at sea, and being unable to ascertain anything respecting the tree that produced it, supposed it to be the production of some unknown submarine plant. It has often been found on the coasts of Ceylon and the Maldivé Islands, drifted thither by some of the mysterious currents which perplex mariners all over the Indian Ocean. The nuts attained in these countries to an almost religious value, and were sold in India for fabulous prices. A medicine was made of the kernel, which was said to possess restorative qualities much in request in those countries where polygamy prevails.

It was not until the discovery of the Seychelles Islands by the French in 1742 that authentic information was obtained respecting the true nature of the tree, and the astonishment of those previously acquainted with the Coco de mer may well be imagined upon their finding large forests entirely composed of this palm, growing most luxuriantly upon a small and quite uninhabited island, and towering far above all ordinary tropical vegetation.

But little is even now known respecting the growth and peculiarities of this extraordinary palm, owing to the great length of time it requires to arrive at maturity, and the consequent difficulty

*Journal of the Linnean Society, VIII, 1865, p. 135

of obtaining accurate information with regard to its development. The information gathered from the inhabitants is not of much value, they are very unobservant, and the truth of their replies to any questions that may be put to them can never be depended upon.

The shortest period before the tree puts forth its buds is thirty years, and one hundred years must elapse before it attains its full growth. No one can tell how long it will last, or how old some of the gigantic specimens may be. No nuts planted since the British came into possession have arrived at their full growth. One in the garden at Government House, planted fifteen years ago, is still quite in its infancy, about sixteen feet in height, but with no stem yet visible, the long leaves shooting from the earth like the Traveller's Palm and much resembling them in shape, only much larger. Nine months after the nut has been planted, supposing germination to have begun at once, the leaf sprouts at an angle of 45° from the root; it is very closely folded, with a smooth hard surface, terminating in a sharp point. When about two feet above the surface it expands, and nine months after another leaf follows, coming up the grooved surface of the midrib of that which preceded it, and so on at intervals of nine months, each succeeding leaf becoming larger in size. All these leaves cluster together and support each other, no stem appearing above the ground. From the age of fifteen to twenty-five the tree is in its greatest beauty, and the leaves at this period much larger than they are subsequently. They consist of two layers of fibres crossing each other at right angles, imbedded in a thick stratum of parenchyma enclosed in a tough skin.

The stem of the full-grown tree, like that of all Palms, consists of hard fibres imbedded in medullary substance enclosed in a hard sheath, so hard that a good axe is required to cut it. It splits readily, but is extremely durable. Unlike the Cocoa-nut trees, which bend to every gentle gale and are never quite straight, the Coco de mer trees are as upright as iron pillars, undisturbed in their position by the heavy gales and violent storms so often occurring in tropical regions.

At the age of thirty the tree first puts forth its blossoms. The male and female trees are quite distinct; and the female blossom may be considered as the germ of the nut, as it offers nothing of the appearance of what is generally regarded as a blossom. The female tree alone produces the nut, and it is twenty feet shorter than the male tree, which frequently attains a height of one hundred feet.

The male flower is an enormous catkin, about three feet in length and three inches in diameter, of a reddish-brown colour, and covered with rhomboidal valvate scales disposed spirally about the stem, from the angles of which the stamens spring. Within its circumference, at intervals corresponding to the apertures from which the stamens shoot, are found little masses containing such a succession of stamens in progressive stages of development that the flowering is maintained for eight or ten years, each coming

stamen thrusting off and replacing the one that preceded it. The whole has a most disagreeable, oily odour, and if cut and put in any accessible place, is greedily attacked by ants. It may be seen in all stages upon the same tree—in full bloom, faded, and quite decayed.

The female blossoms spring from a strong stem forming a regular zigzag, and are composed of three bracts three or four inches in diameter. A gummy secretion exudes from the apex of these, which secretion doubtless arrests and secures the pollen necessary for their fecundation. The fruit stalk is supported by three very strong bracts; the outer one of these, the top of which is wedge-shaped, penetrates the stalk of the leaf immediately above it, in the under side of which nature has left a fissure accessible to it. By this provision the stalk is enabled to support the weight of fruit which hangs upon it, sometimes exceeding four hundred-weight. Eleven nuts have been seen on one stalk, the probable weight of each being about forty pounds. Such clusters are, however, very rare, and four or five may be taken as the average number on one stalk.

From fructification to full maturity a period of nearly ten years elapses. The fruit attains its full size in about four years, and is then soft, and full of a semi-transparent jelly-like substance of an insipid, sweetish taste. The mesocarp is a leathery substance of a brownish-green colour, adhering to the shell. As the nut ripens this gradually dries up into a white, horny kernel, about half an inch in thickness, and of no use whatever, supposed to be poisonous, but, probably, only quite indigestible. The nut in its perfect state is about eighteen inches long, and of the same breadth, something in the shape of a heart, with two separate compartments. It is enveloped, like the Coco-nut in a fibrous husk; but its texture is not nearly so thick or so strong, and it drops off soon after the nut falls from the tree. The nuts, sawn in half, and divested of the kernel, form excellent calabashes, and are universally used for baling boats. The entire nut is frequently used as a water-keg, and holds three or four gallons of water. It has, however, to be "caulked" in the centre, where germination takes place, before it becomes completely watertight.

The arrangements provided by nature for the roots of both male and female trees are of a most peculiar nature, quite distinct from those provided for any other known tree. The base of the trunk is of a bulbous form, and this bulb fits into a natural bowl, or socket, about two and a half feet in diameter and eighteen inches in depth, narrowing towards the bottom. This bowl is pierced with hundreds of small oval holes about the size of a thimble, with hollow tubes corresponding on the outside, through which the roots penetrate the ground on all sides, never, however, becoming attached to the bowl; their partial elasticity affording an almost imperceptible but very necessary "play" to the parent stem when struggling against the force of violent gales.

This bowl is of the same substance as the shell of the nut, only much thicker. As far as can be ascertained, it never rots or wears

out. It has been found quite perfect and entire in every respect sixty years after the tree has been cut down. At Curieuse many sockets are still remaining which are known to have belonged to trees cut down by the first settlers on the island.

This curious arrangement renders it impossible that the trunk could grow in a slanting position; and there is no known instance of its doing so, either on the flat, or on the steep sides of the mountains, in both of which situations the tree thrives equally well.

The high price still fetched by the nuts will ultimately be the cause of their complete extinction in these islands. The growth of the palm is so very slow that no one can expect to reap where he has sowed, and the people consequently never take the trouble to plant any for the benefit of posterity. Not content too with digging up those nuts that have fallen and taken root they ruthlessly destroy whole trees by cutting them down for the sake of the nuts and the heart leaves, which latter are used for making hats, fans and baskets. Many of the trees still standing are quite spoilt by the practice of cutting out these centre or heart leaves, leaving the tree shorn of its beauty, and with an untidy, ragged appearance. Besides the ravages of man, fire is a terrible enemy to these forests, a year seldom elapsing without there being sufferers by accidental conflagrations, especially those forests situated at the north-west end of Praslin, in which are now found only such male trees that from their height overtopped the flames that destroyed the females. At the south-east end of Praslin they are more plentiful the dry season being in the south-east monsoon, and as the forests are to windward, they are not exposed to much danger from spreading fire.

No suggestions will induce proprietors to abandon their present habit of wilfully destroying the trees for the sake of the nuts and leaves, or to take some pains for the cultivation and reproduction of this magnificent palm. Not many years will elapse before the *Coco de mer* becomes in reality as rare as it was supposed to be when first picked up at sea by the wondering mariners, and the only relics left of its former magnificence will be the decaying blackened stumps of the trees so wantonly destroyed, and the curious sockets in which they stood for so many years.

Seycelles, April 16, 1863.

III*

Letters from SIR H. BARKLEY and SWINBURNE WARD, ESQ.,
relative to the *Coco de Mer*.

Government House, Mauritius,
6th June, 1864.

Sir,

Having brought the resolution adopted by the Linnean Society, on 3rd of March, relative to the destruction of the *Sea Cocoa-nut Tree* in the Seychelles Islands, under the notice of the Civil Commissioner of that group, and called upon him to suggest officially

* Journal of Linnean Society, IX, 1866, p. 118.

what measures could be taken to ensure the preservation of the remaining trees, I have received the report of which I now beg to enclose a copy.

The Society will be glad to learn that Mr. Ward did not find on a visit of inspection, that that destruction had been carried so far as had been represented to him, but that, on the contrary, one forest of these palms in Ile Praslin is carefully preserved by its owner, and still contains magnificent specimens.

As this island is almost entirely private property, the interference of the Government would be difficult, except in the way of exhortation and remonstrance; but as Ile Curieuse, where a certain number of trees are found, is still vested in the Crown, and used for a purpose which renders it inaccessible to the public, I trust there can be no danger under any circumstances of the extinction of this most interesting species.

I am confident that whilst Mr. Ward remains in his present post he will do all in his power to protect the existing trees, and to secure the planting of others.

I remain, Sir,

Your obedient Servant,

HENRY BARKLEY.

To George Bentham, Esq.,
President L.S., &c., &c.

Preservation of the Coco de mer.

Civil Commissioner's Office,

Seychelles, May 17, 1864.

Sir,

I have the honour to acknowledge the receipt of your letter (No. H. 890) of May 6th enclosing a communication from the Linnean Society on the subject of the destruction of Coco de mer trees at Praslin, and directing me to report, for the information of His Excellency the Governor, upon the measures which ought to be taken for the preservation of such of the Lodoicea trees as now remain.

The paper on the Coco de Mer, to which the Linnean Society alludes, was written a short time after my arrival; but although I had made a tour of inspection round the islands, including Praslin and Curieuse, I had not then visited the district in which this palm principally flourishes.

There is no doubt that the Coco de Mer has entirely disappeared from many parts of the island of Praslin, where it formally abounded—destroyed by accidental conflagrations, and ruthlessly cut down to make room for manioc cultivation. The land in these parts of Praslin, with a very small exception, is entirely in the hands of private individuals, and no steps could have been taken by Government with respect to preserving the trees.

I returned, on the 9th instant, from a visit to the more distant islands of the group in the "Pleiad," which was placed at my disposal by Colonel Playfair, and I took the opportunity during this tour, of visiting the Lodoicea forest at Aulsebrook, on the southern point of the island of Praslin—a small lovely valley reaching to the sea-board, surrounded by lofty hills, the sides and crests of which are covered with Lodoicea several hundred in number.

This forest is in the property of a Mr. Campbell; and I am glad to be able to report that more care is taken of the trees here than is the case in any other part of the island. They may be seen in all stages of growth, from the sharp, sword-shaped spathe just shooting from the ground, to palms one hundred and twenty feet in height, long since arrived at maturity, and at whose age it is impossible even to guess. None are actually planted by the proprietor; but he occasionally allows nuts to remain and take root where they fall; and as the trees are usually surrounded at the base by thick undergrowth, many other nuts are overlooked by the men employed to collect them, a certain amount of reproduction being thus ensured.

The leaves of the male trees alone are cut for the sake of the material from which hats, fans, and baskets are made. Cutting these leaves prevents the trees from giving any blossoms; but the male trees preponderate over the female, and these growing in almost inaccessible spots, which flower undisturbed, are quite sufficient to fecundate all the female trees in the district. The flowering process continues for years; and the small blossoms that spring from the huge catkin forming the basis, as it were, of the flowers, are reproduced, apparently, *ad infinitum*.

A comparatively small number of trees are found on Curieuse Island, and these never attain the same size and perfection as those at Praslin. Soon after my arrival, I gave directions to Mr. Forbes, in charge of the lesser establishment, to keep up the supply by planting germinating nuts; but he succeeded with but a small proportion of those planted. Unfortunately, too, several trees which were thriving in the vicinity of the cemetery were accidentally burnt. I have directed him to plant all the germinating nuts that he can find for the future, and to take all the care he can of the trees now remaining.

When at Praslin, I selected a Coco de Mer with a perfect healthy germ nearly a foot in length, which I forwarded to Sir William Hooker, by the 'Nomo,' on the 11th instant.

I have the honour to be, Sir,

Your most obedient servant,

SWINBURNE WARD,

Civil Commissioner.

*The Honourable The Colonial Secretary,
Mauritius.*

BOARD OF AGRICULTURE.

EXTRACTS FROM MINUTES.

The monthly meeting of the Board of Agriculture was held at Headquarter House on Monday, the 12th March, at 11.15 a.m. There were present :—The Hon. H. Clarence Bourne (Chairman); Director of Public Gardens; Superintending Inspector of Schools; Island Chemist; His Grace the Archbishop of the West Indies; Messrs. J. W. Middleton, G. D. Murray and Jno. Barclay (Secretary).

Commercial Agent.—The Secretary read the report of the committee appointed in matter of a commercial agent for Jamaica in London, the adoption of the report was unanimously agreed to.

The Chairman asked the Archbishop, Mr. Middleton and Mr. Murray to form a deputation to wait on His Excellency and present the report; and the Secretary was instructed to write the Colonial Secretary and ask when it would be convenient for the Governor to receive the deputation.

Day of Meeting.—As Mr. Murray reported that he could not attend the meetings of the Board if they were held on Mondays, the Archbishop proposed that the meetings should be held on the Wednesday of the same week of the month at 2 p.m., instead of 11.15 a.m.

This was agreed to.

Contagious Diseases.—The Secretary reported that the committee appointed had again revised the draft of the proposed Bill and it had been sent on by the Agricultural Society to the Governor.

Cotton Gin.—The Secretary reported that he had received the Hand Cotton Gin from Mr. Levy, that it had been sent to the Railway workshop for repair and it would be stored in the office for future use.

Diseased Coco-nuts.—A letter was read from the Colonial Secretary informing the Board that Mr. G. P. Dewar had pointed out that he especially desired to call attention to the need for owners of blighted coco-nut trees to be compelled to cure or burn them, as until they were made to do so their neighbours would suffer. He said that when the trees showed any symptoms of unhealthiness they were beyond remedy as the leading bud was rotten and decayed, and that while spraying was good, eradication was better.

The Governor asked the views of the Board on Mr. Dewar's proposal.

The Director of Public Gardens said that Mr. Dewar was wrong in saying that when the trees showed signs of unhealthiness they were beyond remedy, that bud-rot could be cured in its earlier stages by spraying with Bordeaux mixture, which arrested the decay. He had arranged for Mr. Cradwick to visit Lucea on the 19th May and Mr. Dewar could arrange to meet Mr. Cradwick there.

The Secretary was directed to reply to the Colonial Secretary to this effect.

Mr. Nolan's Work.—The Colonial Secretary also forwarded a letter from Mr. Nolan, forwarding cutting from *The Wine and Spirit Gazette*, and also a report of the case which he had instituted under the Merchandise Act with a copy of a prosecution which took place in Lanark under the Food and Drugs Act in which the defendants were convicted.

These were directed to be circulated.

Resignation of Mr. Teversham.—A letter was also read from the Colonial Secretary intimating the resignation of Mr. T. F. Teversham as from the 28th February on account of ill-health.

The chairman stated that various alternative proposals were before the Government and provisions had been made in the estimates of £200 for carrying on the work.

Standardisation of Jamaica Rum.—The following papers which had been circulated but had not yet been before the Board were submitted :

With regard to the standardisation of Jamaica rum, the Director of Public Gardens' minutes on the subject were read to the effect that a standard of this kind was unnecessary and would be injurious to our interests.

Of the members present Mr. Cousins, Mr. Murray, and the chairman were in favour of the proposed standardisation.

Mr. Fawcett was opposed to it and the Archbishop thought that the facts as contained in the papers should be reported to the Governor to form his own opinion.

The Chemist was asked to make a summary of the arguments in favour of his case to be sent first to Mr. Fawcett to state his arguments against it, both then to be circulated among the members of the Board.

Agricultural "Don'ts."—In reference to the above, these having been revised by the Superintending Inspector of Schools with the suggestion of the members of the Board before him, were approved. The Archbishop said that he hoped to get the Board of Education to adopt them and have them hung up in the form of a large chart for use in schools.

Report from Mr. Cousins on his visit to Trelawny and Westmoreland and Report Hope Experiment Station were also presented.

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THE HISTORY OF THE UNITED STATES

BULLETIN

OF THE

DEPARTMENT OF AGRICULTURE.

Vol. IV.

MAY, 1906.

Part 5.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.,

Director of Public Gardens and Plantations.

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P R I C E—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send name and address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA :
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NOTES ON THE "CASTILLOA" RUBBER TREE.

By "A Forester," Bluefields, Nicaragua, Jan., 1906.*

The roots of young plants of *Castilloa elastica* (the Central American rubber tree) are well developed and branch a good deal. They are very thickly clothed with root hairs at the tips. These hairs are very fine and fragile and in transplanting young seedlings great care should be taken not to injure them. I believe that the condition of the roots of a tree makes more difference with the amount of rubber it will give than the leaves. A tree with small yield is generally healthy in the leaves, but has some defect in the roots. Transplants are likely to have defective tap roots and on this account blow over.

There are two distinct types of branches on the *Castilloa* tree—temporary and permanent. All the branches for the first three or four years are temporary. They grow alternately on different sides and almost at right angles to the trunk. After some time the temporary branch drops, when besides the scar which is left will be found a small bud. This bud is either to the right or left of the scar, but never above or below it. Whenever one such bud on a tree grows to the right all the other buds do the same, and *vice versa*. I have never found a tree with buds on both sides. Such buds are the beginning of permanent branches. Only a small number grow into branches, but any of them can be forced by cutting through the bark to the wood, above the bud, and thus severing the sieve tubes connecting the leaves and roots. These permanent branches project upward at an angle of 45° or less. Forced branches do not grow as fast as natural ones. The permanent branch bears temporary branches of its own, and later may bear other permanent branches.

This question of branching may prove important. Some planters claim that trees that put out permanent branches early grow faster and yield better than later branching trees. Others

* From the India Rubber World.

claim that branching is not good for the trees. I believe that branched trees grow somewhat faster because they get a larger leaf surface, but I do not think that this leaf surface affects the amount of latex. Trees planted far apart branch more freely and earlier than those which are close together. There also seem to be more branches on trees grown in the sun than in the shade. It has been suggested that it would be well to grow branches on the trees—by the forced method above described—in such manner that the trees could be ascended by tappers without a ladder. The fact that some temporary limbs turn permanent might be investigated, and perhaps a way could be found to make them turn permanent at will, if desirable.

The *Castilloa* is a fast growing tree. It appears to grow faster between the ages of two and four. The leaf surface of the tree, and consequently the amount of light it gets, has a great deal to do with its growth. Shade grown trees are not nearly so large at the same age as those grown in the sun. Some planters believe that trees grown in at least partial shade yield more latex, but if this is so, I do not believe that they yield enough more to pay for the loss in growth, for under any ordinary conditions the trees yield in proportion to their size. Monthly measurement of a large number of *Castilloa* trees shows that they grow on an average of about $\frac{1}{4}$ inch per month in circumference. This varies, however, the trees sometimes growing not at all for a month and growing $\frac{1}{2}$ inch or more the next month. An experiment in the effect of tapping on growth did not show that it made any difference.

The proper distance in planting depends a good deal on how soon the plantation is to be tapped. Trees planted 10 x 10 feet begin to crowd each other at about six years. If the plantation is to be tapped at this age, or earlier, this is a good distance for planting. When the trees get older, the poorer and weaker ones can be bled out. The experiment of planting four trees in a hole shows that it is possible for two, three, or even all four to grow well and apparently not to hinder each other. If these trees continue as they have begun, it seems to me that the way to grow the most good trees on a given piece of land would be to stake the land at a distance of 15 or 20 feet, and to plant a circle of 8 or 10 trees about each stake. Any trees grown in this way which did not keep up to the others should be cut down, and by the time they are ready to tap there should be three or four good trees in each group. This method would avoid one trouble which has shown itself where one tree was planted to a hole, and that is that when the time for tapping came many of the trees were poor and stunted and not worth anything. This irregularity of growth loses much time and can be avoided where only the best trees are allowed to grow.

Whatever the method of tapping employed for *Castilloa*, the healing of the cut requires to be considered. The general idea has been that the cut must not be made too deep and this is true to a certain extent. But it may also be made too shallow. Be-

tween the bark and the wood is the growing part of the tree, a tissue called cambium. This part alone has the powers of forming new bark and new wood. If a cut is made which does not go into the cambium, the cut will not heal over with new material. Of course, it will dry up and turn black, and in this way protect the tissue under it, but the piece of bark taken out is gone for good. On the other hand, a cut made just to the cambium will heal quickly.

The Pará rubber tree (*Hevea*) shows some important differences in latex from the *Castilloa*. Of course all that I have noted on this tree is done here in Nicaragua and it may behave differently in Brasil or Ceylon. The first noticeable thing in cutting the Pará tree is the small yield. When a *Castilloa* is tapped, the cut is immediately filled with latex, which runs in a small stream from the lower end. The *Hevea* when first cut shows no latex. In a few seconds it begins to appear in drops on the cut surface and after 3 to 5 minutes begins to drop from the end of the cut. The small yield at the first tapping seems to be balanced by the fact that more can be got by multiple tapping. In Ceylon, according to report, the yield increases each day, but here I have noticed no increased yield. I tapped one tree nine days in succession, and though it yielded every day (a thing which *Castilloa* would not do) the yield decreased instead of increasing. The *Hevea* tree will not do here because there is too much labour involved in multiple tapping. I think the trees here, if tapped rightly, would yield as much as those in Ceylon, but as labour cost so much more, it would not pay. I am confident from comparing yields printed in *The India Rubber World* that *Castilloa* will yield as much with four tapping operations a year as *Hevea* will with ten or twenty when the trees are the same age.

COAGULATION OF CASTILLOA RUBBER.

Mr. S. W. Sinclair, *Manhattan Plantation, Bluefields, Nicaragua, to
Director of Public Gardens.*

Manhattan Plantation,
February 2nd 1906.

Dear Sir,

Your favour of June 23rd 1905 has just reached me.

Replying to your enquiry about the Sinclair Coagulator, beg to say that it consists of a piece of board through which holes are bored 2 ins. by 2 ins. (holes should be about $\frac{1}{4}$ inch). Over this board a sheet of absorbent paper is placed, (I enclose sample); paper must be laid on the board wet, if put on dry, it will warp and give an uneven sheet of rubber. Having the board and paper laid on wet, now proceed to tack on the rim or frame, which should be from $1\frac{1}{4}$ in. high to $1\frac{1}{2}$ in. and your box will be ready for coagulating. As soon as the latex is brought in from the field, I add four times its volume of water, then strain through a fine metal sieve; then I place the whole in a cone bottom tin tank to settle, which takes about one hour. I then decant off the water until the

latex becomes as thick as when it came from the tree, then I pour it in my boxes and the water that is in the latex, which can't be decanted off, will pass through the absorbent paper in about 10 minutes leaving the rubber.

I then expose it to a heat of 110 degrees F. for 5 or 6 hours, when the rubber can be lifted off the box.

A new sheet has to put on after being used 10 or 12 times.

The time of exposure to heat varies and it is hard to give a correct formula in this respect, but one soon learns by the feel of the sheets, just when to take them from the boxes. I take them off as soon as my fingers don't stick, when pressed against them.

I may mention here that this method is for *Castilloa elastica*.

The *Hevea* latex passes through the absorbent paper.

I am carrying on experiments now and expect soon to be able to handle both kinds of latex.

Rubber coagulated on the above method becomes transparent like Ceylon biscuits, and runs it a close second in price, we aim to bring it up to par.

With respects, I am,

Yours sincerely,

S. W. SINCLAIR.

GRASS OILS.*

I. CITRONELLA AND LEMON GRASS IN CEYLON.

By HERBERT WRIGHT, Controller of Experiment Station, Ceylon.

(Paper read before the Ceylon Agricultural Board.)

The Citronella industry is far from being in a flourishing condition in Ceylon, and many persons who in the old days found it a profitable cultivation now declare it to be unremunerative. It is common knowledge, however, that Citronella oil exported from Java obtains a much higher price than that from Ceylon, and it has been argued that, if the same price could be realised for the oil exported from this island, it might once more become an industry worthy of serious consideration. Planters in the Straits and the authorities of the Imperial Department of Agriculture for the West Indies are taking up the subject in earnest, and residents in this island are beginning to send in numerous enquiries as to the possibilities with this product. The moment, therefore, seemed opportune to present a few facts regarding Citronella and also Lemon Grass, as results have been obtained at the Experiment Station, Peradeniya, and in various parts of Ceylon.

CITRONELLA.

We will first consider Citronella oil. I have brought with me a sample of one of the grasses from which the oil is obtained, and also a quantity of pure oil fresh from the still. As you are probably not concerned with the exact botanical identity of Citronella grass, I may dismiss that vexed question by saying that the speci-

For previous articles on Grass Oils, see *Bulletins*, March, 1903, p. 53; Dec. 1903 Feb. 1904, p. 43; Oct. 1904, p. 224; March, 1905, p. 49.

men as here presented is as near the wild "Mana" grass as it can be, and is by most botanists regarded as being a variety of the "Mana" grass so common in many parts of this island. The cultivation of Citronella has hitherto been confined to the Southern and South-West Provinces, the Matara, Galle, and Hambantota districts being well-known in connection with this product. Exactly why it has been more or less limited to these localities it is difficult to say, as the grass grows well in districts having an annual rainfall of 80 to 100 inches, and, as will be shown later, has been successfully cultivated at an elevation of 2,000 feet in the Central Province. It is not easy to obtain reliable information as to the yield per acre in these provinces, but it is usually estimated that about 36 bottles each containing $1\frac{1}{2}$ lb. of oil are obtainable per acre per year. If such is the case it can be asserted that the Peradeniya district, at an elevation of 2,000 feet, is as good as any part of the Southern Province for this product. At Peradeniya one acre of the Maha-pangiri variety gave in 1904 19,320 $\frac{1}{4}$ lb. of grass, from which 84 lb. of pure oil were obtained; in 1905, the same plot produced 5,757 $\frac{1}{4}$ lb. of grass, which yielded 38 lb. of oil. This one-acre plot gave in the second and third year from planting 122 lb. of oil or 61 lb. per year. From other plots in their first year 60 lb. of oil were obtained per acre.

VALUE.—Messrs. Chas. P. Hayley & Co., of Galle, have offered 85 to 88 cents per lb. for the crude unfiltered oil. The yields I have given you were obtained from a plot on the rocky hill-side facing the Peradeniya Gardens, which was previously occupied by Mana grass and Lantana. It is not a rich soil but a typical patna-like compound similar to what may be seen in many parts of the Island. The results show that we can obtain a crop of 60 lb. of oil per acre per year (210 to 250 lb. of grass giving 1 lb. of oil), the oil realising from Rs. 51 to Rs. 53 per acre in Galle. It must be admitted that this is not a very big return, but it is about as much or even more than what is obtained on many Citronella estates. The yearly expenditure for weeding, cutting, transporting and distilling is probably about Rs. 20 to Rs. 30 per acre, and if the good variety is cultivated it will require re-planting every third year at a cost of Rs. 3 per acre. In addition to such current expenditure one must allow for clearing, for plants, and the wear and tear of the machinery. It is obvious from these remarks that Citronella cultivators are not rolling in profits, and various points will require attention if the prospects of the industry are to be made brighter.

POINTS REQUIRING ATTENTION.—The first and foremost is to check the adulteration which has been practised, so that Ceylon can obtain a better reputation and command a price equal to that paid for the oil exported from Java. This matter is, as most of you are aware, receiving the attention of Government, and it is not necessary for us to make any remarks beyond pleading for a cessation of adulteration, or exporting the adulterated article under definite grades, so that buyers will know what they are purchasing. Another point of practical importance is the complete condensa-

tion of the oil. Often the oil and water, as they pass into the receiver, are quite warm instead of being cold. The cold water should enter the condensing chamber at the end furthest from the distilling chamber, so that the oil-vapour will meet a cooler atmosphere the nearer it gets to the receiver. I find in practice that a 60 foot coil of piping, 3 to 4 inches in diameter, is sufficient to effect perfect condensation, and it is the opinion of many that the good yield of oil obtained at Peradeniya is partly due to the completeness of the condensation which is obtained. There are other points of importance which might be touched upon, but beyond advising the planting at definite distances, instead of at haphazard, selecting the better variety and paying attention to the seasons and the time of cutting, I propose to dismiss the subject of Citronella. As most of you are aware, certain Citronella planters have found relief in quite another way, namely, by taking up the cultivation of Lemon grass in place of Citronella.

LEMON GRASS.

The main reasons which have led to this change are, first, that Lemon grass oil is valued at 35 to 40 cents an ounce in Galle; and, secondly, the grass can be cultivated and distilled in just the same manner as Citronella. Of course, the demand is not an unlimited one, and the price may be lowered if too much oil is placed on the market. The Lemon grass is quite a different plant, but, as you can see from this specimen, it is similar in many respects to Citronella grass. It yields a valuable oil, a pure sample of which I have placed on the table for your inspection. The practical details connected with Lemon grass cultivation are identical with those of Citronella, and therefore need not be dealt with here. The points to consider are the yield and value of the oil. I cannot give you the figures of outsiders, but the results at the Experiment Station are probably similar to those obtained elsewhere. At Peradeniya, at an elevation of 1,600 feet, the grass can be cut six months after planting, and from one plot, which was planted in July, 1904, we obtained in December of that year 8,063 lb. of grass yielding $13\frac{1}{4}$ lb. of oil per acre, the same plot cut in April of this year gave 5,281 lb. of grass and 13 lb. of oil per acre so that the yield per acre in the first year has already been $26\frac{1}{4}$ lb. of oil. This works out at 40 cents per ounce in Galle, at over Rs. 160 per acre in the first year. You will remember that the Citronella may give a gross return of Rs. 51 to Rs. 53 for the same period. The ease with which these products are cultivated is remarkable. All that is necessary is to make holes, mamoty wide and mamoty deep, and plant young shoots in rainy weather. Nearly all the plants will grow well, and the grass can usually be cut and distilled six months after planting.

CONSTITUENTS REMOVED.—In comparing the value of Lemon grass as against Citronella, it is as well to bear in mind the effect of cultivating these products on the soil. In each case the weight of grass removed is considerable, and it is somewhat surprising that crops so exhausting can be grown on relatively poor soils. In order to emphasise this point I now quote the results of analyses

made by Mr. Bruce, which show that every 10,000 lb. of Lemon grass contain about 65 lb. of potash, 12 lb. of nitrogen, 12 lb. of lime, and 9 lb. of phosphoric acid. The same quantity of Citronella grass removes less potash and lime but more nitrogen and phosphoric acid. The weight of Citronella grass per acre is usually much greater than that of Lemon grass, and is in most cases the more exhausting of the two.

Sufficient has been said to show that we have in Lemon grass and Citronella two products which can be regarded as catch crops since they gave a return six months from planting ; the cultivation is simple, the plants are very hardy and seem to be comparatively free from disease. They can be grown on poor soils in a very large part of this Island, and there is a fair demand for the oil. It is proposed to publish the results in detail in the Magazine of the Society, and to show by means of diagrams and photographs the nature of the plants and also the machinery, used in these industries, and it is therefore unnecessary for me to prolong my remarks.

THE DISCUSSION.

H. E. the GOVERNOR : You mentioned that the cost was Rs. 30 an acre ?

Mr. WRIGHT : That was for cutting the grass, transporting, and distilling, and also weeding.

H. E. the GOVERNOR : Does anybody know about the range of these grasses—the elevations at which they would grow ?

Mr. WRIGHT : Hitherto they have been confined to the Southern Province ; and this is the first time, I believe, that we have grown them at 2,000 feet elevation at Peradeniya.

H. E. the GOVERNOR : I have seen some plants growing very freely at Nuwara Eliya, 6,000 feet elevation, apparently in Patana land ?

Mr. WRIGHT : Citronella grass, as is well-known, is a variety of the Mana grass, which grows wild. Wherever Mana grows you might undoubtedly grow Citronella grass.

H. E. the GOVERNOR : We might try it somewhere in the hill country.

Mr. WRIGHT mentioned the Horton Plains.

The Hon. Mr. J. FERGUSON enquired if Mr. Wright would recommend planters who had Mana grass fields to try Lemon grass or Citronella.

Mr. WRIGHT thought there would be no objection provided the planting was considered a part of the co-operative experiments being carried on by the Department. Any particular product that the authorities considered experimental they would help the planters to grow, provided they gave the results in return.

The Hon. Mr. J. FERGUSON : Are co-operative experiments to be introduced at different elevations ?

Mr. WRIGHT said that was a matter they wished to see brought forward. They would carry out experiments and see if certain plants would grow at every thousand feet elevation.

Mr. FERGUSON remarked it would be well for the Society to get planters to make co-operative experiments. As regarded elevation, Mr. Campbell mentioned to him that in the Himalayas at 7,000 feet elevation that grass grew.

H. E. the GOVERNOR : What I observed two days ago showed that this grass will grow up to 7,000 feet; we can try several elevations. We have got at the present moment a certain number of gentlemen in various parts of the Colony who are prepared to assist us in experiments, and whose names are noted as being affiliated for the purpose.

VARIATION IN YIELD AT CERTAIN SEASONS.—MR. FERGUSON : Mr. Wright might be able to give us details as regards crops in relation to acreage.

Mr. WRIGHT said that there was a great variation in the weight of grass obtained at certain times of the year and in the weight of the oil. In the case of Citronella, taking three seasons' records it roughly worked out at 1 lb. of oil from 250 lbs. grass. On the other hand from Lemon grass they roughly got 1 lb. of oil from 500 lb. grass. Lemon grass, of course, was smaller. He pointed out that at the end of the dry season they got more oil from a given quantity of grass.

SOIL EXHAUSTION AND ROTATION.—Dr. H. M. FERNANDO remarked that it was well-known that Citronella grass exhausted the soil to a great extent, would it therefore be advisable to plant it as a catch crop among coco-nuts, etc.?

Mr. WRIGHT explained that Citronella was very exhausting to the soil if grown alone, but if it was associated with other products the exhaustion was far from being at all dangerous to cultivation. If at the end of two or three years they did not re-open land in Citronella or Lemon grass but adopted a rotation crop, either of crotalaria, or ground nuts, or even chillies—he had seen that product used in the Southern Province—they would get better results from the soil after that. Of course, if they did not grow anything with coco-nuts or cocoa or rubber the land would lose all the same by being allowed to remain exposed.

Mr. FERGUSON pointed out that the gross return from Lemon grass was given at Rs. 160 an acre, and Citronella Rs. 54. Was there any particular reason for the difference?

ADULTERATED OIL.—Mr. WRIGHT explained that in the old days Citronella oil obtained a better price than Lemon grass oil. The price was simply the result of the greater demand for the one article than the other. They might be able to raise the price of Citronella oil by exporting it under a Government guarantee of purity. At the present time Citronella oil was simply adulterated.

H. E. the GOVERNOR : Am I to understand that the price obtained for Citronella oil, at the present time, is the price of adulterated Citronella oil exported from Ceylon?

Mr. WRIGHT :—It is the price of crude, unfiltered oil.

The Hon. Mr. W. H. JACKSON wished to know if any analysis had been made of the waste grass after the oil had been expressed.

He had seen it used for stocking the still. It might be returned to the soil.

Mr. WRIGHT remarked that he, too, had seen it used as fuel and also to feed cattle which seemed to relish it greatly. The only thing that was lost by using it as fuel was the nitrogen. The potash would be there and the lime. The ashes might be used on the land.

PLANTING UP PATANAS.—The Hon. Mr. W. H. JACKSON said that if the grass grew like Mana they might try it on waste land which, in places, grew nothing but Mana.

H. E. the GOVERNOR: That is what is proposed to do near Hakgala—to grow it on Patana land.

Mr. WRIGHT:—I have already established places at Bandarawela. Will that place answer?

The Hon. Mr. W. H. JACKSON:—I think so. That is about the barest place.

II. LEMON-GRASS OIL FROM MONTSERRAT*

A specimen of lemon-grass oil was forwarded to the Imperial Institute in September, 1903, by the Hon. F. Watts, Government Analytical and Agricultural Chemist to the Leeward Islands, with the request that its commercial value might be ascertained.

In the letter accompanying the sample, analyses of this and other West Indian lemon-grass oils were given, and the characteristic partial solubility of these oils in alcohol was noted. No information was given, however, regarding the exact botanical origin of the Montserrat oil, and as a knowledge of this point is of some importance in placing such products on the market a request was made for a herbarium specimen of the plant from which the oil was distilled, in order that it might be identified; at the same time a larger sample of the oil was asked for. These supplementary materials were received in January, 1904.

Identification of the Plant.

The herbarium specimen of the plant was submitted for examination to the Director of the Royal Gardens, Kew, who identified it as *Andropogon nardus*, L. var *genuinus*, Hack. which is commonly known as the true lemon-grass.

Chemical examination of the oil.

The oil was examined in the Scientific and Technical Department of the Imperial Institute, and gave the following results:

The specimen measured about eight fluid ounces, and consisted of clear, limpid, yellow liquid, with a pleasant lemon grass odour. It dissolved to the extent of about 97 per cent. in 70 per cent. alcohol, and on distillation about 25 per cent. of the oil was obtained between 180°–220° c., and 50 per cent., which was principally citral, between 220°–230° c.

The following table shows the analytical results obtained with the Montserrat oil both at the Imperial Institute and in the West

* From Bulletin of the Imperial Institute, II.

Indies, and for convenience of comparison the corresponding figures for commercial lemon-grass oil distilled in India from *Andropogon citratus*.

	Montserrat Lemon-grass Oil.		East Indian Lemon-grass Oil.
	Imperial Institute Analysis.	Mr. Watts' Analysis.	
Specific gravity at 15° c. ...	0·906	0·886	0·899 to 0·903
Angle of rotation in 100 m.m. tube	—0°10'	—0°12·6'	+1°25 to 3°5'
Citral determined by the sodium bi-sulphite method	74·6%	74·2%	70 to 75%

These results indicate that the Montserrat oil contains as large a proportion of the valuable constituent citral as the East Indian oil, and only differs from the latter product in being incompletely soluble in 70 per cent. alcohol.

Lemon-grass is now principally employed as a source of citral, and the commercial value of the oil depends principally upon the amount of this constituent contained in it.

Commercial valuation of the oil.

Specimens of the oil, accompanied by a statement of the results of its chemical examination, were submitted to dealers in essential oils both in this country and on the Continent for commercial valuation. The reports from these firms indicated that, although in some cases there was a tendency to quote a low price (4½d. per oz.) for this oil owing to its being incompletely soluble in alcohol, yet the general opinion appeared to be that, if placed regularly on the market in fair quantities, it would be worth from 5d. to 6d. per ounce, which is about the price of good quality East Indian oil at the present time.

These results indicate that Montserrat lemon grass oil, in spite of its peculiar partial insolubility in alcohol, would probably find a ready sale at remunerative prices in this country and on the Continent.

AGRICULTURE OF PORTO RICO.*

Porto Rico is essentially an agricultural country. This follows, as a natural result, the even climate, the cheap labour, and the good market for the various products of the soil.

* From *Register of Porto Rico for 1906*, Compiled by the Secretary of Porto Rico, December 1906.

Since the American occupation there has been a steady increase in the acreage under cultivation, and, owing to the generally good prices obtained in the fiscal year just passed a marked impetus has been given to the raising of sugar, coffee, cattle, tobacco, cotton, citrus fruits, pineapples, cocoanuts, &c.

Land suitable for agricultural purposes has increased at least 20 % in value during the past year, and hardly an acre of ground within a radius of 15 miles of San Juan can now be purchased for less than \$100. In the country districts, within easy access of the railroad or macadam roads, fairly good land will average \$40 per acre; and in the interior and in places remote from transportation, grazing land can still be purchased as low as \$5 to \$10 per acre.

Much credit is due to the United States Agricultural Experiment Station for its practical demonstrations of what crops can be grown to advantage in Porto Rico, and of the most modern methods of cultivation. This information is made public by bulletins issued by them from time to time.

There has been a marked increase in the importation of modern agricultural implements, which admit of the cultivation of larger tracts of land with little additional labour.

Fertilizer is also used much more extensively than in former years, and in order to guarantee the quality of the same, the last Legislative Assembly of Porto Rico passed an Act to regulate the registration and inspection of commercial fertilizers, fertilizer materials and chemicals in Porto Rico. This law makes it a misdemeanour to sell for offer or sale in this island any fertilizer or fertilizer material which does not conform to the formula given on the tag attached to the package.

As a further incentive to agricultural pursuits, the Legislative Assembly appropriated the sum of \$10,000 for the development of the fibre plants of the island, this sum to be expended under the direction of the Governor in the purchase of fibre or other product grown by planters on the island, the purchase and operation of machinery for the preparation of such products for marketing, or in such other ways as in his opinion will best tend to the demonstration of the possibilities of growing and marketing such products upon a remunerative basis to persons engaging in such work.

In order to afford every possible protection to coffee, cotton, and citrus fruits, the last Legislature also passed a law to guard against the importation of plant diseases or insects harmful to plants. This law provides that no coffee tree or plant, or any portion thereof, or the seeds of same (except roasted coffee for domestic consumption), and no rooted citrus plants or cuttings, and no cotton seed, seed cotton, cotton lint, loose or in bales shall be brought into the island of Porto Rico from any state or territory or other country whatsoever, without having attached thereto in a prominent and conspicuous place, a certificate under oath signed by a duly authorized state or government entomologist, stating that such trees, plants, roots, seed hulls or seed, and any

and all portions thereof are free from disease ; provided that in the case of cotton seed, seed cotton, cotton seed hulls or cotton lint, such certificate shall state in addition that the shipment originated in a locality where, by actual inspection by said attesting official or his agent, the Mexican Boll Weevil was not found to exist.

Sugar has been grown in Porto Rico since 1548 and unquestionably has now supplanted coffee as the chief source of the Island's wealth.

For the fiscal year 1904-1905 there was exported (almost entirely to the United States) 271,325,118 lbs. of an estimated value of \$11,925,804, as against 259,294,060 lbs. of an estimated value of \$8,690,814 for the fiscal year 1903-1904.

The good price obtained for last season's crop has boomed the sugar industry of the Island and great activity is now being shown in the opening up of new land, formally used only for grazing purposes, in order to supply the growing capacities of the mills. New centrals have been built, others are in course of construction and all the old factories of any importance are installing modern machinery.

The introduction of improved agricultural implements into the island during the past few years, has permitted the more rapid exploitation of great areas of land at a considerably less rate of expense than was formerly possible. The use of fertilizer has become more prevalent and has amply repaid those who have made use of it.

The manufacture of sugar can be undertaken profitably only by capitalists, and on a large scale with modern machinery. Sugar land is easily worth \$100 per acre and a sugar central will cost approximately \$1,000,000. A net profit of \$75, to \$100 is a fair yield per acre.

COFFEE.

Coffee, which has always formed one of the three principal staples of the island, is now attracting much interest in the United States, and the tide of public opinion seems to have at last turned in its favour. This is evidenced by the fact that previous to the Spanish-American war but one-half of one per cent. of the coffee crop of the island went to the United States, while in the fiscal year ending June 30th, 1903, the States took three per cent. of the crop, and in the fiscal year ending June 30th, 1905, they took nine per cent. This shows a steady increase in the quantity exported to the United States, and, as a convert to Porto Rican coffee can never be induced to use anything else, it is confidently expected that in the near future the coffee crop of Porto Rico will again reach the high water mark of 60,000,000 pounds as in 1896, and will be almost entirely consumed in the United States. Every effort is being made to create a market there for the Porto Rican bean and the last Legislative Assembly passed an Act providing for the establishment of a Commercial Agency in the United States for the sale of coffee and other products of Porto Rico. This agency is now open for business

at No. 91 Wall Street, New York City, and it is the duty of the agent in charge to correspond with the coffee planters and dealers, and other producers in Porto Rico, with a view of putting such growers and producers in direct communication with purchasers of such products and to promote in every way possible the opportunity for growers and producers to market their products directly with purchasers. All products consigned to the agency will be disposed of to the best advantage and without charge to the shipper other than for cost of transportation, storage, and actual expenses incurred in marketing the same.

Coffee can be grown profitably on nearly all kinds of soils, provided there is a good drainage. Virgin forest soil on the mountain sides, however, is the best, and much of this land can still be had for about \$10 per acre. In order that the Porto Rican coffee may command the highest prices it must be able to compete with the fine grades of Java coffee. With this end in view the Coffee Experiment Station is now experimenting with fine coffees from all parts of the world. Samples of these and their breedings will be sent to the United States markets, and after it has been demonstrated which best suit the American taste, these selected varieties will be recommended to the coffee growers and, if possible, seeds or seedlings will be placed at their disposal. Experiments are also under way to increase the production per acre, which now averages about 250 pounds as against a far larger output in other countries. Until quite recent years the cultivation of coffee was conducted in a very primitive way, but the cultivation now is conducted along up to date lines and seed and nursery beds are found in the coffee districts where a few years ago only volunteer plants were used.

TOBACCO.

The poor prices paid for ordinary leaf tobacco on the field during the past two years, disheartened the farmers, and, in consequence, the 1905 crop was a very small one. There was a good demand this season and much higher prices were paid, and the few fortunate farmers who had not exchanged their crops for provisions or sold their field of tobacco before picking, made very fair profits. It was a somewhat unusual occurrence for the bulk of the profit to be made by the farmers, as they usually sell to speculators, who, in turn, sell to the factories. The farmers have been greatly encouraged by the rise in price and knowledge that in future the factories will buy direct from them, and as a result a large crop is being prepared for 1906.

The new system of picking the leaves for wrappers from the standing plants and drying separately from the stalk, has given very good results, and wrappers treated in this way have greatly improved in quality and have brought a much better price. Tobacco grown under cheese-cloth continues to give good results; this method of planting is gradually extending and proves very profitable if carried out on a large scale.

The cultivation and curing of leaf tobacco in Porto Rico is still in a very crude state: the land is badly prepared and the

seed not judiciously selected ; for instance, some districts whose speciality is fillers use the same seed as those that grow tobacco for wrappers. and vice versa : there is no uniformity of leaves among the plants, the seed principally used is mixed, and therefore, gives a variety of plants ; and finally, practically no fertilizing is done, although an increase of from 25 to 30 per cent. can be obtained by its careful application. It is worthy of note, however, that the stimulus of this year's good prices has made the farmers more careful in the selection of seed, in cultivating and in fertilizing.

The style of barn in which the drying is carried on (very little curing being done by the farmers) is responsible for the spoiling of half the tobacco brought in from the fields, they are usually open at the sides and the tobacco is at the mercy of the wind and rain. Very fine tobacco is often destroyed by careless handling and improperly built barns, and tobacco which would be worth \$15 to \$18 per quintal if properly dried, will not bring more than \$10 or \$12 if carelessly handled. The barns should be so constructed that they may be immediately and tightly closed, or opened for ventilation.

There is a great future for leaf tobacco in Porto Rico, especially for light wrappers, if modern methods are adopted, but it is difficult to persuade the average farmer to give up his old way of doing things.

CATTLE.

Cattle raising in Porto Rico has always been a profitable business, as there is a continual demand both for beef cattle and for draught animals. Some few American mules and horses have been imported for ploughing and other agricultural work, but, while they accomplish more in a given time, they are more expensive to keep, as they require grain if used for heavy work. Oxen, on the contrary, feed entirely on grass, and, although slow, are steady workers and accomplish a great deal of work. Practically all the hauling to the towns in the Island which are not connected by railroad, is done by bullock teams which draw immense loads. While it is true that, owing to the increased area which is being devoted to the raising of cane, the available pasturage has been greatly reduced, still there is plenty of land in the interior of the Island suitable for cattle raising, which can be bought for from five to ten dollars an acre. Prior to the American occupation there was a large export trade to Cuba and adjacent islands, but this has been gradually falling off, as is shown by the fact that 13,110 cattle were exported during the fiscal year 1903-1904, while only 8,185 were exported during the fiscal year 1904-1905.

The native horses, though small in size, are tough and wiry, and as they live exclusively on grass they are inexpensive to keep. They make good coach and saddle horses and almost all the travel from one part of the island to another is done either by coach or on horseback.

III

The native mules, although small, make very satisfactory pack animals, and are used extensively for the transportation of coffee from the mountains to the shipping points.

All the livestock in Porto Rico has deteriorated greatly owing to the continual in-breeding, but steps have been taken to improve the breeds by crossing with good stock brought from the United States.

CITRUS FRUITS.

It is estimated that there are 7,000 acres under cultivation at this time in citrus fruits, of which about 70% is planted in oranges, 25% in grape fruit (pomelo) and 5% in lemons. This acreage is continually increasing and there will be approximately 1,500 acres more planted during the next twelve months. Among the varieties of oranges most commonly planted here are the Parson Brown, Ruby, Washington Navel, Pineapple, Hart's Late, Valencia Late, Enterprise Seedless, Jaffa and the native: and among the grapefruit are the Duncan, Walters, Bowen, Marsh Seedless and Thomson Seedless. This acreage has all been set out in citrus fruits since the American occupation, and although sufficient time has not yet elapsed for the marketing of a full crop, yet some shipments were made from these groves last winter which reached New York in good condition and brought a fair price. This has demonstrated that Porto Rican oranges, if intelligently handled, have the necessary keeping qualities and will bring good prices. In past years shipments were made of the native orange gathered from trees scattered around, but they were shaken from the trees, carried to the point from which shipment was made in baskets on pack animals, and then packed promiscuously in boxes and barrels without any attempt at sorting. Naturally this fruit arrived at its destination in poor condition and required so much re-handling and sorting that there was very little margin for profit, and the Porto Rican orange acquired the reputation of being a poor shipper. Now, however, that the oranges can be gathered from the groves where they receive intelligent supervision from the time they are picked until they are placed aboard the steamers, it will take but little time to overcome any bad impressions that may have been created.

The present rate of freight from Porto Rico to New York on a box of oranges is about 28 cents, as compared with 35 cents freight and 56 cents duty from Cuba, 98 cents freight from California, and 72 cents freight from Florida. This allows quite a margin in favour of the native fruit as far as the question of freight rate is concerned. While it is true that the two steamship companies running between Porto Rico and New York do not at this time provide adequate facilities for the shipping of fruit, yet they have made every assurance that as soon as there is a sufficient quantity of fruit to warrant it, they will undoubtedly meet the situation.

A careful study of the conditions in Porto Rico would seem to indicate that in order to obtain the best results, oranges and grapefruit should be budded on the native rough lemon stock. In a

majority of the groves the trees are set out 25 feet apart, making about 70 trees to the acre. One advantage of this system is that pineapples may be planted between the rows for the first two or three years. The principal drawbacks with which the orange growers here have to contend are the wind, scale and ants; the former may be overcome by a wind-break, and the scale and ants can be kept within bounds by constant spraying and washing.

The Porto Rico citrus fruit proposition is an enticing one and there is apparently little risk in the venture. It does not require a large capital, as nursery trees of all kinds can be bought in Porto Rico at \$25.00 a hundred; land, according to location, from \$20.00 to \$100.00 per acre, and unlimited labour can be secured at from 30 to 50 cents a day. There is absolutely no reason why a grove that has received careful and intelligent cultivation should not return to the grower a net profit of \$200.00 per acre at the end of the fifth year and a proportionately greater profit in the succeeding years.

PINEAPPLES.

Pineapple culture has been taken up largely by the orange growers as a means of deriving some income while waiting for their groves to come into bearing. When planted between the rows of trees, about 4,000 pineapple plants can be set out to the acre without interfering with the trees, and when planted by themselves from 8,000 to 10,000 pines can be set out to the acre. The pines which appear to grow best in Porto Rico are the Red Spanish, the Cabezona, the Pan de Azucar and the Smooth Cayenne. Red Spanish is the favourite with the planter as it has shown good keeping qualities and shipments have brought on an average of \$2.50 per crate, thus allowing a handsome profit to the grower. The good returns from last season's crop has resulted in the planting of a greatly increased acreage and it is estimated that at least 4,000,000 plants have been set out this year.

The climate of Porto Rico seems to be peculiarly adapted to the raising of pineapples and careful cultivation and a little fertilizer show a corresponding increase in the size of the fruit. Several canning factories are now in operation and as a good supply of fruit is now assured, more factories will soon be erected.

COTTON.

Forty years ago the cultivation of cotton in Porto Rico had developed into an important industry, the larger portion of the crop being planted in the southern districts. From 1879 to 1903, however, the cultivation of cotton was practically abandoned. In 1903 interest in cotton was again revived and some few farmers planted small tracts as an experiment. The quality of the fibre obtained was so desirable that the acreage has been gradually increased and it is estimated that there are now about 6,000 acres under cultivation. The quality of the fibre of the crop of 1904 met with favour both in the United States and in Europe, but this year the fibre has been found to be very weak and inferior and the planter has been discouraged by the low prices obtained. It is claimed by the cotton experts on the island that the inferiority of

this year's crop is due to the fact that poor land was used for planting, that fertilizer was not used, that the cultivation was indifferent, and that the cotton was picked before it had sufficiently matured.

Experiments have proved that a good quality of Sea Island cotton can be grown in Porto Rico which will average a yield of 1,200 to 1,700 pounds per acre. Suitable land can be procured for about \$40.00 per acre.

As yet neither the Boll Weevil nor other serious pests has made its appearance. The caterpillars have done some inconsiderable damage but they were quickly exterminated by the use of Paris Green—they only attacked the leaves and generally left the bolls uninjured.

COCO-NUTS.

Coco-nut trees are scattered all through the island but grow to best advantage along the coast, and where these trees can be found in any large number close to some shipping point the coco-nuts can be handled quite profitably. There are some few groves on the island now in full bearing and many more are being set out. About fifty trees are planted to the acre and a good crop can be gathered at the end of the seventh year with a corresponding increase in the quantity of coco-nuts as the trees become older. Coco-nut trees require very little care from the time they are planted until they come into full bearing, and land suitable for the growing of coco-nuts can be bought as low as \$10.00 per acre, but the price increases according to the proximity to a shipping point.

THE NATURE AND COMMERCIAL USES OF BEN OIL.*

[The first part of the article condenses the information published in the Bulletin of the Department of Agriculture, Jamaica, Jan., 1904, on MORINGA, then comes the following:—]

A firm of oil manufacturers in Kingston, Jamaica, have recently made an experiment to ascertain the cost of production of the oil. They paid 8s. per cwt. for the seed, and found that the husks constituted 40 per cent. and the decorticated seeds 60 per cent. The seed when expressed warm, but not hot, yielded about 12½ lbs. of oil per cwt. Their final result showed a cost of £80 per ton for the oil. A sample of this oil was sent to England for valuation, and a report was received which stated that "Oil of Ben" was now superseded by an oil obtained from the head of the sperm whale, and that the value of the sample submitted was about equal to that of the best cotton seed oil.

In May, 1903, a small specimen of Ben oil was supplied to Dr. J. Lewkowitsch from the Imperial Institute. A report on this sample has been published in "The Analyst, 1903," vol. 28, p. 343, from which the following extract is taken:—"The chief interest in this oil depends on its low iodine value; this explains why the

* From Bulletin of the Imperial Institute, II., 1904, pages 117-120.

oil is specially applicable for lubricating watch-springs and other delicate machinery." The following constants were determined:

Specific gravity at 15°C. (water at 15°C.—1)	0·91267
Iodine value	72·2
Iodine value of the liquid fatty acids	97·53
Refraction (butyro-refractometer)...	50·0°

A sample of pods and seeds which were identified as those of *Moringa pterygosperma* has been received recently at the Imperial Institute from Northern Nigeria. On examination in the Scientific and Technical Department, the seeds were found to contain 38 per cent. of a pale yellow oil which was almost odourless, and possessed a bland agreeable taste. This oil (obtained by extraction with ether) consisted of a liquid and a solid portion which were separated by filtration at 17 to 18°C. and separately examined.

The analytical constants of these two portions are given in the following table:—

	Liquid portions.	Solid portions.
Specific gravity at 15°C. ...	0·914	·
Acid value ...	15·3	·
Free fatty acids (calculated as oleic acid) ...	7·7 %	·
Saponification value ...	189·2	194·4
Ether value ...	173·9	·
Iodine value ...	70·7	68·3

Samples of the seed and of the oil were submitted to brokers for valuation. They reported that in order to obtain trustworthy commercial quotations, large samples of the oil would be necessary for practical trials, and that if the results of these trials proved satisfactory the oil would probably be able to compete for edible and culinary purposes with American refined cotton seed oil, which is at present worth about £22 per ton. The seeds were valued at about £7 per ton delivered in London.

Another sample of Ben oil from Jamaica was received at the Imperial Institute in December, 1903. It had a very slight, pleasant odour, and an agreeable taste. On examination in the Scientific and Technical Department it yielded the following results. When filtered at 17°C. it was found that 60 per cent. of the material was liquid, whilst the remaining 40 per cent. consisted of a nearly white solid fat. The liquid portions was clear, bright and of a pale yellow colour. The constants of these two portions were found to be as follows:—

	Liquid portions.	Solid portions.
Specific gravity	0·9124 at 15°C.	0·8650 at 100°C.
Acid value	8·7	7·2
Free fatty acids (calculated as oleic acid)	4·4 %	3·6 %*
Saponification value	196·3	193·6
Ether value	187·6	186·4
Iodine value	70·1	65·2

* Compared with water at 15°C.

From these accounts of Ben oil, it appears that although it would not yield the extravagant profits expected in 1817, yet if it could be produced at a sufficiently cheap rate it would be likely to find a market for dietetic purposes, and possibly an opening might be secured for the liquid portion of it as a lubricant for fine machinery.

The cost of producing the oil as given by the firm of oil manufacturers at Kingston, Jamaica, appears very large; it must be pointed out, however, that the initial cost of the seed was very considerable, the yield of oil was less than would be expected from the fact that the decorticated seed contains from 35 to 38 per cent. of oil, and no allowance seems to have been made for the residual cake which might be of value as a cattle food.

SNAILS AND SLUGS.*

NATURAL ENEMIES.

By far the greatest natural checks are birds, which not only eat slugs, but are especially partial to snails, breaking their shells against a stone and picking out the mollusc. Toads are great devourers of slugs and small snails. Poultry and ducks eagerly search for them. Centipedes attack slugs, and ants frequently kill snails, but none of the foregoing save birds do any appreciably good in keeping down an excess of these molluscan creatures.

PREVENTION AND REMEDIES.

The following may be mentioned as tending to prevent and lessen the attacks of these pests:—

- (i) Drainage, because dampness favours them.
- (ii) Avoid long manure, or in fact any organic manure where slugs are abundant in the soil. Employ artificials *for a time*.
- (iii) Dry dressings of some irritant to kill the pests. (a) Soot and lime; (b) salt and lime; (c) lime and caustic; soda or to act mechanically, (d) powdered coke.

The lime must be in a very finely-divided state and quite fresh. *Two or three dressings must be given*, the second some 15 to 30 minutes after the first. Lime and caustic soda is found to act best—four parts of caustic soda to 96 of lime well mixed. Dry dressings, except powdered coke, should be applied very early in the morning.

- (iv) “Rings” of slaked lime or fine ash soaked in kerosene may be put round choice plants.
- (v) Heaps of bran-mash or moist oatmeal or cornmeal may be placed here and there. These baits attract the slugs, which may then be easily collected.
- (vi) Heavy applications of soot are best to keep off snails, which should be dealt with mainly by hand picking and by trapping with cabbage leaves.

*Extract from Leaflet No. 132, of Board of Agriculture & Fisheries of England.

- (vii) Rows of peas, &c., are best protected either by spreading cinders and lime along the rows, or by heavy dressings of slaked lime.
- (viii) Hedge bottoms, and rough herbage at the base of walls should be cleaned out and the masses of hibernating snails crushed.
- (ix) Land that is thoroughly fouled with slugs should be treated with gas-lime and in the winter deeply trenched.
- (x) Ducks and poultry should be kept, as they greedily devour both kinds of pests.
- (xi) Birds should be encouraged. It is easier to keep them off fruit than to suppress the snails and slugs which they largely devour.

INSECT PESTS.

The following letter has been received from Dr. Howard, Chief of the Bureau of Entomology of the U.S. Dept. of Agriculture.

This weevil was killing the Camphor trees at Cinchona, but has not been noticed on any other trees. If it be a fact, as Dr. Howard supposes, that this insect pest has been imported in some way from Central America, it is an additional proof of the necessity of stringent precautions against such importations by careful fumigation.

*Dr. L. O. Howard, Chief of Bureau of Entomology, Dept. of Agri.
U.S.A., to Director of Public Gardens and Plantations, Jamaica.*

Washington, D.C.
December 21st, 1905.

Dear Mr. Fawcett,

I have received yours of the 7th instant, with specimens of larva and beetle found attacking young camphor trees at the Botanic Garden at Cinchona.

Mr. Schwarz reports that the weevil is *Hilipus elegans*, Guérin. of the family Curculionidae. There are several hundred species of this tropical or sub-tropical genus known from Central and South America, including a few species from the West Indies. Your species is not a native of the West Indies, but has been manifestly imported during recent times from some part of Central America where the insect is said to be quite abundant. Nothing is known of the habits of any of the species, but since the genus *Hilipus* is closely allied to our northern pine weevils it may be inferred that they live under bark of various deciduous trees. I am not able to give you any remedial measures, but any camphor tree that shows the least sign of being affected by the weevil should by all means be uprooted and burned.

Yours very truly,

L. O. HOWARD,
Chief of Bureau.

A NEW SPECIES OF FERN OF GENUS POLYPODIUM FROM JAMAICA.

By WILLIAM R. MAXON, U. S. Nat. Museum, Washinton, D. C.*

Among the ferns collected in Jamaica by the writer in 1904 is a simple-leaved *Polypodium* which is distinct from the several related species of middle America. It may be known as *POLYPODIUM NESIOTICUM*, new species.

Rhizome suberect, about 1 cm. long, densely clothed with closely appressed imbricate lanceolate dull light-brown scales; fronds few, approximate, 15 to 22 cm. long; stipe relatively very short (1 to 2 cm. long), densely beset with slender spreading rigid reddish hairs; lamina (largest) 20.5 cm. long, 0.9 cm. broad, bright green, firm, moderately thick, linear-lingulate, rather blunt at the apex, attenuate and decurrent at the base, the under surface sparsely hairy, the upper surface glabrate, the margins regularly marked by broad shallow undulations, ciliate; midvein apparent on the under surface nearly throughout, on the under surface concealed by the parenchyma except towards the base; venation free, the oblique veins for the most part alternately 3 to 5 times forked; sori round, either terminal or dorsal, wholly superficial, 2 to 4 to each group of veins irregularly disposed in two or four interrupted rows.

JAMAICA—Founded upon a single specimen, U. S. National Herbarium, No. 520,770 from the vicinity of Vinegar Hill, altitude 1200 meters; William R. Maxon, No. 2773; June 23, 1904. Growing upon the trunk of a forest tree, ten feet from the ground.

The present species appears to be a very rare member of a group of tropical American species represented in Jamaica by the well known *Polypodium trifurcatum* L. and by *P. Fawcettii*, Baker,† and *P. dendricolum*, Jenman‡ the last apparently very close to the Colombian *P. parietinum*, Klotzsch.§ *P. Fawcettii* and *P. dendricolum* have been well distinguished by Jenman|| since their original publication. *P. nesioticum* is very distinct from both, but for the benefit of those who have not material of these rare species the following notes may be of use.

P. Fawcettii is correctly said by Jenman to be "infrequent at 4,000 to 6,000 feet altitude in damp forests on the trunks and branches of trees." Two numbers (2723, 2760) were collected in such situations by the writer in 1903 and 1904. It is characterized, briefly, by its dark villous slender conspicuously upright rhizome, numerous closely set small, very narrow fronds, and almost simple veins,—the sori being borne in two rows near the midvein, each upon a short spur given off by the otherwise simple

* Reprinted from SMITHSONIAN MISCELLANEOUS COLLECTIONS (QUARTERLY ISSUE) volume 47. Published April 5, 1905.

† *Journ. Bot. Brit. and For.* 27: 270. 1889.

‡ *Gard. Chron.* III. 16; 487. 1894.

§ *Linnaea* 20; 373. 1847. Illustrated by Kunze, *Farrenkr.* 2; 41. pl. 117, f. 1. 1848-1851.

|| *Bull. Bot. Dept. Jamaica* II 4, 68-69. 1897.

vein. In all these characters the plant contrasts strongly with *P. nesioticum*.

P. dendricolum appears to be a very rare species. Professor Underwood states (*in litt.*) that it is "represented at Kew only by a tracing of the type," the type being presumably in the Herbarium of the Jamaican Botanical Department at [Hope Gardens] Kingston, Jamaica.* There is, however, a single frond from the type specimen preserved in the Jenman herbarium at New York, and this agrees absolutely with two other numbers of Jamaican specimens, *viz.* : one (without definite locality), collected by D. Watt in 1903; and another from the slopes of Monkey Hill (above New Haven Gap), altitude about 1,800 meters, Maxon, No. 2,736; both of which numbers are represented in the herbarium of the New York Botanical Garden and the U.S. National Herbarium. This species is somewhat more closely related to *P. nesioticum* than is *P. Fawcettii*. It is distinguished by its reduced stature (5 to 7 cm.), thicker texture, more general villous covering, deeply scalloped (instead of undulate) margins, simpler venation, and particularly (1) by having the mid-vein covered on both surfaces by parenchyma, and (2) by what Jenman calls "embossed spectacles," *i.e.*, having the parenchyma considerably raised (on the under surface) above the concealed veins toward their extremities, thus imparting a marked rugose effect to the under surface. The last character is sufficient in itself to distinguish *P. dendricolum* at sight.

The venation of *P. nesioticum* is peculiar and shows an approach to that of *P. trifurcatum*. . .

BOARD OF AGRICULTURE.

EXTRACTS FROM MINUTES.

The usual monthly meeting of the Board of Agriculture was held at Headquarter House on Wednesday, 11th April, 1906, at 2 p.m., present:—The Hon. H. Clarence Bourne, in the chair, the Director of Public Gardens, the Superintending Inspector of Schools, His Grace the Archbishop, the Island Chemist, Messrs. C. A. T. Fursdon, G. D. Murray and the Secretary.

Commercial Agent.—In the matter of a Commercial Agent to represent Jamaica in London, the Secretary reported that His Grace the Archbishop, Mr. G. D. Murray and himself, (Mr. Middleton being ill with fever), met His Excellency in the forenoon of the day of the meeting, who, after discussing the matter, promised to put it before the Privy Council.

The Secretary was directed to forward to the Colonial Secretary the report of the Committee on the matter; and letters from Mr. A. R. Davey of London to the Archbishop which the latter submitted in confidence.

Standardization of Rum.—The papers referring to the standardization of rum were put before the meeting, but as they had not circulated round the Board, the Secretary was directed to send them on.

* The type with Jenman's name in his own handwriting is in the Herbarium at Hope Gardens. *Editor Bulletin of the Department of Agriculture.*

A cutting from the *Glasgow Herald* forwarded by the Chemist, pointing out the variation of the contents of ethers in Jamaica rum and the necessity for a standard, was submitted.

Agricultural Don'ts.—A letter from the Superintending Inspector of Schools to His Grace the Archbishop, referred to the Board, was submitted, asking the Board if it could supply a copy of "Agricultural Don'ts" Chart to every school in the island.

After discussion the Secretary was directed to write the Colonial Secretary informing him that this Chart has been prepared at the instance of, and was approved by the Board, that it had been revised by and had the approval of the Superintending Inspector of School, and asking His Excellency to approve of the cost of such charts to be issued to all schools being placed on the estimates either of the Agricultural or Education Department for next year.

Letters from the Colonial Secretary's Office were submitted among others on the following subjects:—

1 *Salary of Superintendent of Field Experiments*.—*Re* increase in salary to Superintendent of Field Experiments, advising that the Governor approved of the reduction of £30 of the amount for "Distillery Materials for Estates" and of the increase by £20 per annum of the salary of the Superintendent of Field Experiments.

2 *Resignation of Mr. Teversham*.—*Re* resignation of Mr. Teversham.

Agricultural Scholarship.—Forwarding copy of a Bill entitled "The Scholarship Law, 1901, Amendment Law, 1906," His Grace the Archbishop and the Superintending Inspector of Schools thought it was not advisable to reduce the Scholarship below £180 per annum which they thought the lowest figure that a student could pay his way at Cambridge. Mr. Cousins, Mr. Fursdon and Mr. Murray considered that £156 per annum was under the circumstances sufficient. Mr. Fawcett thought that it was not desirable that there should be any change in the Scholarships, but that the examination for the Jamaica Scholarship might be so arranged as to ensure the teaching in schools of the principles of Agricultural Science and so encourage the students to adopt agriculture as a profession. Under the circumstances the Chairman agreed with the majority.

The Secretary read two letters he had received from the Secretary of the Schools Commission as follows:—

(1) *Examination for Agricultural Scholarships*.—In reply to the report by the Island Chemist expressing regret at the disappointing results of the recent examination for agricultural scholarships at the Government Laboratory, pointing out that it was no doubt due to the existence of an impression among students that learning in scientific agriculture, as a profession, would not afford them as good means of livelihood as the practice of one of the learned professions.

(2) *Cambridge Local Agricultural Section*.—Transmitting copy of

letter from Dr. Cairns, Cambridge, in reply to one addressed to him conveying suggestions by the Island Chemist for the amendment of the second part of the Agricultural Science Section of the Cambridge Senior Examination, intimating that the syllabus had been modified in the direction suggested by Mr. Cousins; also asking Mr. Cousins if he had any further remarks to make on the schedule. A copy was referred to the Chemist for his remarks.

Cotton Gin.—The Secretary submitted an offer of Mr. Sharp of £5 for the Cotton Gin now in his possession.

It was resolved not to accept the offer, and meantime to retain ownership of the Gin of which Mr. Sharp had the use.

Mr. Cradwick in St. Mary.—The Secretary submitted a letter from the Hon. R. P. Simmonds making application for the services of Mr. Cradwick in connection with the St. Mary show to be held on the 5th July, asking if he would be allowed to spend the first week in June, and the week of the show in St. Mary.

After discussion it was agreed that Mr. Cradwick could spend the first week in June and the week of the show in St. Mary, but that he should return to his ordinary duties the day after the show.

Reports.—The following reports from the Director of Public Gardens were submitted and directed to be circulated:—

1. Hope Experiment Station.
2. Instructors.

The following reports from the Chemist were submitted;—

1. Proposal as to distillers' course at the Laboratory. This was approved of.
2. Report on successful working of new plant at Hampden estate.
3. Distillery progress in Westmoreland.
4. Appropriation Accounts Government Laboratory and Sugar Experiment Station for 1905-06.
5. Mr. Calder's enquiries as to Agricultural Students with memo from Chemist. All these were directed to be circulated.

The following papers, which have been circulated, were now submitted for final consideration:—

1. Reports of two cases instituted under the Merchandise Marks Act.
2. Letter from Mr. Nolan forwarding cutting from the *Wine and Spirit Gazette*.
3. Report Hope Experiment Station.
4. Reports Mr. Cradwick.
5. Letter from Mr. J. B. Sutherland re apprenticeship of his son at Hope Gardens.

The meeting then adjourned till 16th May at 2 p.m.

[Issued 14th May, 1906.]

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BULLETIN

OF THE

DEPARTMENT OF AGRICULTURE.

Vol. IV.

JUNE, 1906.

Part 6.

EDITED BY

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Director of Public Gardens and Plantations.

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P R I C E—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send name and address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA :

HOPE GARDENS.

1906.

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JAMAICA.

BULLETIN

OF THE

DEPARTMENT OF AGRICULTURE.

Vol. IV.

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Part 6.

NOTE ON SILK WORMS FROM COLOMBIA.

By M. GRABHAM, M.A., M.B.

Notes on *Attacus jorulla** :—250 young larvae received from M. Patin, (Belgian Consul to Colombia) in June 1900. Eggs brought by him from Sta. Fé de Bogota, Colombia. He stated that their natural food was a species of *Hippomane*, as this food plant was not obtainable here, the sandbox (*Hura crepitans*) and Plum (*Spondias purpurea*) were used at his suggestion. Branches of the trees were isolated in bags of mosquito netting and the larvae placed on the leaves. They grew well in their early stages, but in the final moults most of them refused to eat and died. It was thought that this might have been due to the lack of moisture, M. Patin said that in the Andes about Sta. Fé the moisture was intense. The leaves were frequently sprayed but this had no effect. Some larvae were kept in an insectarium and fed on freshly gathered leaves; these fared no better. About ten spun very indifferent cocoons and about six moths developed—all of very feeble vitality. A few eggs laid by these moths did not hatch. Specimens of the moths were placed in the Museum of the Institute of Jamaica; and some were sent to the U.S. National Museum at Washington for identification.

The common Wasp (*Polista* sp.) proved the most formidable enemy, killing and devouring the caterpillars whenever they approached too close to the netting.

REPORT ON THE TANNING MATERIALS AND MANUFACTURE OF LEATHER IN JAMAICA.†

By M. NIERENSTEIN, Ph. D.

Plants.

The following plants yielding tanning materials are stated to occur in the Island: *Acacia Catechu*, *Bauhinia variegata*. ‡ *Caesalpinia coriaria* (Divi Divi), *Laguncularia racemosa* (white mangrove). Of

* The identification was made by Dr. Dyar of the U.S. National Museum.

† Quarterly Journal. The Institute of Commercial Research in the Tropics, Liverpool University. Vol. I, 2, April, 1906.

‡ *Acacia Suma* (not *A. Catechu*) occurs in Jamaica: it closely resembles *A. Catechu*, and has similar properties. *Bauhinia variegata* is generally known as the "Butterfly Tree." Editor, *Bulletin of the Department of Agriculture, Jamaica*.

these "Divi-Divi" pods and the barks of the red and white mangroves appear to be in regular use in the Colony.

There appears to be a small export trade in tanning materials; thus, in 1903, 478 tons* of Divi-divi pods were exported, principally to Germany, France, and the United Kingdom, and in the same period, 133 tons of bark were exported, part of which was probably bark for tanners' use. Comparison with Dominica, where tannin-yielding plants, such as *Cassia fistula*† *C. Siamea*† and (*Terminalia Catappa*),† "are found, and with Mauritius, where "Badamir bark" (*Terminalia Catappa*), and "Jamrose bark" (*T. Mauritanica*) occur, lends support to the supposition that these plants also occur in Jamaica.

Only about a year ago different Australian species of *Eucalyptus* appeared on the European market, such as *Eucalyptus occidentalis* (Mallet Bark) and *E. oleosa* (Morrel Gum), containing 52 to 55 per cent. of tanning materials: the export of these new materials has been a great success. I find that in the West Indies different kinds of *Eucalyptus* are to be found, especially *E. punctata*.‡

It seems that the Logwood industry suffers in Jamaica through the so-called "Bastard Logwood," which does not contain the dye stuff, and according to F. S. Earle, late of the New York Botanical Garden, who has been in Jamaica,§ "a wise policy would ensure the prompt destruction of such trees whenever detected, as they have no value except for firewood, and should not be allowed to produce seeds." A. G. Perkin, and also the present writer have found that there is a close relationship between the tannins and colouring matters in the plants. The relation between the Divi-divi and Algarobilla¶ plants containing 40 to 50 per cent. tannins, with the logwood, makes it probable that the "Bastard Logwood" could find use as a tanning material.

A similar relationship exists between *Quercus tinctoria*, from which the dye stuff "Quercitron" is obtained, and some different kinds of oak used for tanning, such as *Quercus robur*, *Q. pendunculata*, &c., where, with the increase of the tannins, the amount of colouring matters becomes less. From the tanner's point of view the cultivation of *Laguncularia racemosa* (white mangrove), which has been mentioned as being found in Jamaica, should be very successful, as it would be one of those very seldom obtainable exotic plants which could be used for tanning light leather, and if produced on a large scale could compete successfully with "Mangrove extract;" this substance, which is principally derived from the bark of a tree found in the German Cameroons, produces only dark leathers.

* See figures in succeeding article.—Editor.

† These trees are all cultivated in Jamaica.—*Terminalia Catappa* is commonly known as the "Almond" although it is very different from the almond of commerce. There is a native *Terminalia* (viz.: *T. latifolia*), called "Broad Leaf." Editor.

‡ Species cultivated in Jamaica include *E. Globulus* (in Blue Mts.) *E. citriodora*, *E. saligna*, *E. robusta*, *E. rostrata*. Editor.

§ See *Bulletin of the Department of Agriculture, Jamaica*, Vol. I. Part 2, Feb. 1903, pages 30, 31. Editor.

¶ Algarobilla is the name given to seed-pods of *Prosopis Algarobilla*, a native of the Argentine Republic, and *P. juliflora*, native of Mexico, and mountainous lands south to Chile. Editor.

There is also a good opportunity for introducing other plants which contain tannins, and would grow successfully in those one and a half million acres not cultivated at present. Of course according to the reports of the Kew Botanical Gardens, the attempts to introduce Gambier in the West Indies has not been a success, but I have reason to believe that this is due to the sensitiveness of the plant to climatic changes. Similar observations have been made by M. Greshoff on Gambier of the Malay peninsula.

But greater success can be expected from the introduction of "Quebracho Colorado." * Quebracho belongs to those trees which would probably prosper there, and which are very important in the tanning trade. 3,525 tons of Quebracho Extract were imported in the years 1898-1902 from Argentina into the United Kingdom, and about one quarter of the 11,786 tons, which have been imported to Germany, were sent afterwards to British ports.

HIDES AND SKINS.

It seems that there is not much breeding of cattle, sheep, &c., done in Jamaica, † which is rather astonishing, as the island seems to have open waste pastures and plenty of Guinea and Scotch grass, both well adapted for the feeding of cattle. As to the cattle of Jamaica, Mr. B. M. Greaves, of Portmadoc, who recently visited the island, writes to me, "I think I saw more Shorthorn cattle than any other sort, and some of them were really good looking beasts." The sheep seem to be of a similar build to the Welsh, and could be used in this case for making "roller leather;" (this is used for covering the wheels of cotton spinning machinery). There is a good market for this kind of sheep skin in Great Britain.

G. M. Rummel, of the Bureau of Animal Industry, U. S. A. Department of Agriculture, describes the Barbados sheep in the *Breeders' Gazette* as follows :—"The skin is thicker over the upper part of the ribs than in other parts of the body, and becomes thicker towards the tail, the difference of the rump being quite perceptible. Loose skin (not folds, however) may be seen on the top of the neck." A leather tanned from a sheep's skin as described is sure to have a market.

According to the reports of Messrs. P. C. Cork and J. M. Gibb, V.S., the conditions of introducing and breeding sheep in Jamaica are favourable.

LEATHER MANUFACTURE.

The Leather manufacture seems to be quite in its infancy. There are in Jamaica only twenty-one tanneries, employing in all fifty-five persons, and producing from twenty-eight to thirty-one tons of leather per annum. There is, however, a large import trade in raw and manufactured leather; thus unwrought leather to the value of £6,027, and leather manufactures valued at £66,999, were imported in the year 1903-4.

* *Quebrachia Lorentzii*, growing chiefly in province of Corrientes, Argentine Republic. *Editor*.

† The official statement by the Collector General gives the number of horned stock as 107,694 in the year ended 31st March, 1905. *Editor*.

CONCLUSIONS.

What has been stated above indicates that there is a possibility of developing the leather industries in Jamaica. The following methods might be mentioned :—

1. To develop the cultivation of tanning trees and plants, especially the White Mangrove.
2. To investigate the question of the Bastard Logwood in respect to tanning properties.
3. To introduce tannin-containing plants from the other West Indian islands, and the *Quebracho Colorado*.
4. To encourage the breeding of cattle and sheep, and to try to introduce the Barbados sheep.
5. To develop tannin extract works : it would be advisable to try with primitive methods, similar to those used in South America, and to develop them afterwards into more modern methods.
6. To develop the present important industry of leather manufacture.

Probably the Bastard Logwood would contain a tannin which yields "bloom" on the leather.

I notice in the last number of the *Collegium* that the German Consul in Freemantle (Australia), has been ordered by his Government to collect the seeds of *Eucalyptus occidentalis* (Mallet Bark) and *E. oleosa* (Morrel gum), mentioned in my paper, for the purpose of introducing into Hereroland, western parts of West Africa and inner parts of the Togo.

STATISTICS OF TANNING MATERIALS AND LEATHER FOR JAMAICA.*

EXPORTS OF TANNING MATERIALS.

Statement showing the export of Divi Divi and bark of all kinds for the three years 1902 to 1905.

Countries.	DIVI DIVI.		
	1902-3.	1903-4.	1904-5.
United Kingdom	...	45,800 lbs.	2,600 lbs.
Canada	...	...	2,050 "
Germany	274,387 lbs.	98,504 "	84,137 "
France	44,646 "	30,154 "	59,403 "
Mexico	7,000 "	...	...
BARK OF ALL KINDS.			
United Kingdom	£1 1 0	1,782 lbs.	29,472 lbs.
United States of America	20,990 lbs.	3,500 "	810 bags.
" "	(Mangrove)		
" "	£20 6 0		

*Supplied by the Hon. Collector General, Jamaica.

France	£42 19 0	294,215 "	213,362 lbs.
Canada	...	...	18,900 "
Holland	...	...	2,240 "
Germany	£112 0 0		
Bermuda (Lace)	£7 6 0		

IMPORTS OF LEATHER MANUFACTURED AND UNWROUGHT.

IMPORTS 1903-4.

Leather manufactured, viz. : Boots and Shoes.

United Kingdom	...	£21,455 19 10
United States of America	...	35,587 10 11
Canada	...	134 2 4
Germany	...	220 1 10
Foreign States	...	7 5 2
Cuba	...	4 12 4
British West Indies	...	0 11 0
Austria	...	20 5 8
Hayti	...	0 11 0

		£57,431 0 1
United Kingdom	...	219 13 6
		£57,650 13 7

Leather, viz. : Other manufactures unenumerated.

United Kingdom	...	£3,377 10 3
United States of America	...	994 14 3
Canada	...	5 12 9
Germany	...	39 0 1
France	...	27 2 3

		£4,443 19 7
United Kingdom	...	22 15 6
		£4,466 15 1

Saddlery and Harness.

United Kingdom	...	£7,518 0 4
United States of America	...	1,653 12 9
Canada	...	21 15 10
Germany	...	19 15 9
Cuba	...	3 6 0

		£9,216 10 8
United Kingdom	...	1 0 0
United Kingdom	...	127 4 0
United States of America	...	4 17 6

£9,349 12 2

Leather Unwrought.

United Kingdom	...	£4,179 14 10
United States of America	...	1,848 2 4

£6,027 17 2

IMPORTS 1904-5.

Leather manufactures, viz. : Boots and Shoes.

United Kingdom	...	£17,981	19	10
United States of America	...	31,302	18	9
Canada	...	40	6	3
Germany	...	206	4	6
Hayti	...	0	16	6
British West Indies	...	48	9	11
Austria	...	121	4	4
British East Indies	...	5	8	9
Cuba	...	0	11	0
Foreign States	...	17	18	0

 £49,725 17 10

United Kingdom	...	692	13	0
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 £50,418 10 10

Leather, other manufactures.

United Kingdom	...	£2,365	4	7
United States of America	...	470	5	0
Germany	...	58	17	6
Foreign States	..	0	17	7

 £2,895 4 8

United Kingdom	...	49	13	3
----------------	-----	----	----	---

 £2,944 17 11

Saddlery and Harness.

United Kingdom	...	£5,158	14	8
United States of America	...	912	5	8
Canada	...	19	5	0
Germany	...	4	19	0
Cuba	...	6	12	0
Bermuda	...	6	12	0

 £6,108 8 4

United Kingdom	...	4	8	0
----------------	-----	---	---	---

 £6,112 16 4

Leather unwrought.

United Kingdom	...	£3,441	8	10
United States of America	...	2,111	2	0
Germany	...	5	11	10
Norway	...	0	2	2

 £5,558 4 10

BRAZILIAN COFFEE LEGISLATION.

The "Times" says :—In our *Financial and Commercial Supplement* for February 19 we published a letter from our Rio de Janeiro correspondent describing the new law which empowers the Executive to regulate the trade in coffee, in agreement with the governments of the coffee States of the republic. On Monday Reuter received a telegram from Rio de Janeiro to the effect that the Presidents of the States of Rio de Janeiro, Minas Geraes, and St. Paulo have signed an agreement with regard to the pricing of coffee, and stipulating for a *minimum* price on the home markets of 55f. to 65f. (gold) per sack of 60 kilogrammes of No. 7 grade coffee. "The contracting parties also agree to take measures of a nature to prevent the export of the inferior qualities of coffee, to push advertising in Europe, and to reduce the acreage under cultivation. They finally authorize the State of St. Paulo to raise a loan of £15,000,000."

SEA ISLAND COTTON SEED FOR 1896.

Hon. Sir D. Morris to Director of Public Gardens, Jamaica.

Imperial Department of Agriculture for the West Indies,

Barbados, March 31, 1906.

Sir,

I have the honour to enclose, for your information, copies of an extract from the "Agricultural News" containing a statement of the arrangements proposed to be adopted by this Department for supplying specially selected and disinfected Sea Island cotton seed during the coming planting season.

2. I also enclose a copy of an announcement which I have recommended to appear in the *Official Gazette* and of a "Notice" in regard to the conditions under which selected seed will be shipped by this Department.

3. It is desirable, in order to maintain the high quality of the West Indian product that, as far as possible, only the specially selected and *disinfected* seed supplied by the Department should be planted in these colonies. I trust you will do all you can to encourage and advise planters in this direction. Recent prices ranging from 17d. to 20d. per pound prove that by a systematic selection of seed West Indian cotton is steadily attaining a higher standard of quality than the average cotton produced in the Sea Islands. During the last few weeks applications for West Indian seed on a large scale have been received from Florida, Cuba, and Porto Rico.

I have the honour to be,

Sir,

Your most obedient servant,

D. MORRIS,

Commissioner of Agriculture for the West Indies.

ENCLOSURE.

[Reprinted from the *Agricultural News*, Vol. V. p. 97.]

It is recognized that the most important matter requiring attention, in order to maintain the high quality of the Sea Island cotton produced in the West Indies, is to plant seed obtained from healthy plants that have given a good yield per acre, and that have produced lint which has fetched the highest price during the current season. The experience of a successful cotton grower is :—The selection of seed is the one thing that cannot be overlooked.

As it will be impossible to obtain further supplies of seed from the Sea Islands, the West Indies have to depend on their own resources. This is not a difficult matter, provided growers realize the necessity of making the selection of seed a matter of the first importance. They should be prepared to take some trouble in making themselves acquainted with the subject, and in carrying out for themselves the process of seed selection, or they should be prepared to pay a reasonable price for selected seed. Seed of inferior quality should not be planted on any account. The difference in cost between good seed and inferior seed is a small matter as compared with the difference in the price realized for the crop.

The general lines on which cotton growers are recommended to make a choice of cotton seed for planting during the coming season are these : First, the plants from which it has been obtained should be thoroughly healthy, and they should not have suffered severely at any time from the cotton worm or other pests. The next point is to ascertain that the plants are of good habit and are prolific, yielding, on an average, say, not less than 200 lb. of lint per acre. The third point, and perhaps the most important of all, is that the plants have yielded lint that obtained the highest prices during the current year.

As already stated, the Imperial Department of Agriculture has undertaken a series of experiments in seed selection that are likely to prove of great value to the industry. These experiments are intended to cover the careful selection of seed, on field results, for immediate planting, as well as the systematic selection of improved seed from individual plants, as described in the *Agricultural News* (Vol. V, p. 38), for future years.

It has been abundantly proved by general experience both in the Sea Islands and in the West Indies, that it is impossible to obtain first-class cotton from inferior seed. In Egypt, also, the importance of selecting good seed is fully recognized. Mr. Foaden states :—‘Of all plants, cotton responds the most liberally, as far as both yield and quality are concerned, to careful treatment, and the sowing of good seed is the very first essential to the production of good stapled cotton. However careful our land may be prepared and manured, the production of superior cotton from inferior and mixed seed is an impossibility.’ Further, there is the opinion of the British Cotton-growing Association, as fol-

lows: 'The bulk of the cotton from the West Indies is turning out very well, but you must impress on all the growers the necessity for *very careful selection of seed*, and extreme care in cultivation and handling, for unless Sea Island cotton is quite right in all respects, it suffers severely in price.'

As announced in the columns of the *Agricultural News* (Vol. V. p. 89), the Imperial Department of Agriculture is prepared to supply specially selected and disinfected cotton seed for planting during the months of May to August next, and to deliver the seed at any port in the West Indies at the rate of five cents (2½d.) per lb. Applications for such seed will be received by the principal agricultural officers in each island, as follows: For Antigua and Montserrat, by the Hon. Francis Watts, C.M.G.; for St. Kitt's, Nevis, and Anguilla, by Mr. F. R. Shepherd; for Barbados, by Mr. J. R. Bovell, F.L.S., F.C.S.; for St. Vincent, by Mr. W.N. Sands. Applications from Jamaica, British Guiana, Trinidad, and other colonies not mentioned above, may be forwarded direct to the Imperial Commissioner of Agriculture, Head Office, Barbados. All applications will be dealt with in the order in which they are received.

In order to prevent disappointment in regard to the germinating qualities of the seed, it is recommended that immediately on its arrival it be turned out of the bags or barrels, in which it is packed, and spread out on a dry floor in order that any excess of moisture may be removed. After the lapse of a day or two, the seed may be replaced in the bags or barrels, and kept until it is planted.

It is also recommended that about 100 seeds, taken from the bulk, be sown in soil, or placed between folds of damp cloth, as described in the *Agricultural News* (Vol. II, p. 153), in order to test its germinating power. In the event of doubt arising as to the condition of any selected cotton seed received from the Imperial Department of Agriculture, a sample of not less than 100 seeds should be forwarded within seven days from the date of the arrival of the seed, to the agricultural officer through whom it was ordered, in order that it may be carefully tested. It should be borne in mind that the best results are likely to be obtained when the selected cotton seed is sown within a period of one month after it has been received.

CAMPHOR IN CEYLON.*

By M. KELWAY BAMBER, Government Chemist, and J. C. WILLIS, Director Royal Botanic Gardens.

The recent establishment by the Government of Japan of a monopoly of the production and sale of camphor in Formosa has attracted much attention to this product, and at the same time, by raising the market price, has rendered it by no means unlikely that this may prove to be a profitable cultivation in Ceylon. The

* From Circular, Royal Botanic Gardens, Ceylon. Series 1.—No 24, November, 1901

present circular is issued to lay before the planting public the chief facts connected with this industry, and to describe the methods of cultivation and preparation which have been found best suited to Ceylon in the experiments so far tried with this tree.

The total export of camphor to Europe and America is perhaps about 60,000 piculs annually, or 8,000,000 lb. The market value of crude camphor in Europe is at present about 155 shillings per cwt., or about 1s. 4½d. per lb. Camphor was formerly used chiefly as a drug and for the prevention of insect ravages in clothing, &c., but of late years, in addition to these uses, it has been largely employed in the manufacture of smokeless powders and of celluloid. The tree also produces an oil—camphor oil,—obtained with the camphor in the preparation of the latter, and which is used in the manufacture of soaps and for other purposes.

BOTANY.

Common, Formosa, Chinese, or Japanese camphor is the product of *Cinnamomum Camphora*, Nees, a tree occurring native along the eastern side of Asia, from Cochin-China to Shanghai, and in the islands from Hainan to South Japan; its limits of latitudinal range are from 10° to 34° N., but it is cultivated in Japan to 36° N. In the southern parts of its range it occurs chiefly in the hills.

Two other forms of camphor are frequently met with, though rarely exported to Europe. Barus, Bhimsaini, Borneo or Malay camphor is the product of *Dryobalanops Camphora*, Colebr., a large tree of the family Dipterocarpaceæ, occurring in the Islands of Sumatra, Borneo, &c. This camphor is slightly heavier than common camphor, and is highly prized by the natives of India and China, who purchase the entire very small produce at fancy prices, from 100 to 200 shillings per pound. A third form, Ngai, or Blumea camphor, is prepared in S.E. China from *Blumea balsamifera*, one of the family Compositæ. In Ceylon the natives prepare a small quantity of camphor from the roots of cinnamon, *Cinnamomum zeylanicum*, a plant nearly related to the true camphor. In the remainder of this paper only the common camphor, *Cinnamomum Camphora*, will be dealt with.

In its native country the plant grows into a tree about 100 feet high with a trunk 2 to 3 feet in diameter. It is evergreen, with moderate sized laurel-like leaves, which when crushed smell strongly of camphor. It may be well to mention in this connection that the tree is very handsome when young and forms one of the best ornamental trees for roadsides, parks compounds, &c., in Ceylon.

The native habitat of the species is not widely extended, but it has been successfully cultivated in Ceylon, India, Australia, Florida, California, and elsewhere. It was introduced into Ceylon by the Royal Botanic Gardens in 1852. In 1895 plants were largely distributed from Hakgala to many planters and others. These were the result of seeds obtained in the autumn of 1893 from Japan. Mr. Nock, Superintendent of Hakgala, has collected

information about these trees, some 950 in all, and reports as follows:—

“During 1895 plants of camphor were distributed from Hakgala to planters in various parts of the Island at elevations ranging from 250 to 6,450 feet, with annual rainfalls varying from 54 inches on 104 days to 217 inches on 212 days. Replies as to the growth of the plants have been received from thirty localities, and I think it is pretty well proved that under certain conditions of soil and climate camphor will thrive at all elevations in Ceylon from about sea level to the highest mountains.

“It appears to thrive best in a well-drained deep sandy loam in sheltered situations with a rainfall of 90 inches and over, and dislikes poor or close, stiff, undrained soil. The growth is slow in sterile soil, but, under favourable conditions, in good soil is very rapid, the tree reaching a height of 18 to 20 feet in five years, with a spread of branches of 8 to 12 feet and a stem of 6 to 7 inches in diameter. This compares very favourably with the growth of the trees in their native habitat, where a tree 30 feet high and 6 inches in diameter at ten years old is considered good. The best five-year old tree (from planting) in Ceylon is at Veyangoda, at an elevation of about 100 feet with a rainfall of about 100 inches on 180 days. It is 25 feet high and growing luxuriantly. The next best are at Hakgala, where the largest is 20 feet high, with a spread of 13 feet, and a stem-diameter of $7\frac{1}{2}$ inches at the ground.

“The habit of the trees in Ceylon in good soil is bushy, with a tendency to throw up many stems. This is a point of importance, as it shows that the tree will coppice well and stand frequent cuttings or prunings, and possibly even plucking of the flush as with tea. In close, hard, undrained or stiff clayey soil the growth is poor, and the habit stunted or dwarfed, and this is also the case in exposed windblown situations.

“Of course it is only in the experimental stage here yet, but judging from my experience of it for some years, it is my opinion that as a minor product it should be grown in the form of hedges, planted at distances of 6 to 9 feet apart and 2 to 3 feet apart in the row. The rows should run N.W. and S.E., or across the directions of the prevailing winds, and the plants be allowed to grow 6 to 9 feet high. Planted in this way there would be ample room for cultivation, and each row would shelter the other from the N. E. and S.W. winds, besides forming a large surface for clipping. As the young shoots appear to yield the most camphor, the crop could be obtained by clipping the hedge with a pair of light shears, and the expense would be very slight. The trees might also be planted at 6 feet apart, and treated in the same way as tea bushes, or they might be planted 12 feet apart, and trained as pyramids, or again planted 4 feet apart and alternate plants coppiced in alternate years.”

PROPAGATION, CULTIVATION, &C.

Mr. Nock states:—

“Camphor plants are best and easily propagated from seeds.

The seeds do not keep well, and should be sown as soon as possible after ripening. They ripen in Japan, which at present is the only important source of seed, in October and November, and should be ordered some time in advance, so as to obtain them as soon as they are ripe. I find it a good plan to soak the seed in water for twenty-four to forty-eight hours before sowing, agitating the water occasionally. The best seeds, being heavier, will sink to the bottom, and these should be sown thinly by themselves; the lighter ones should be sown thickly, as only a small percentage will germinate.

"The seeds should be sown in well-prepared beds of sandy loam and leaf mould; they should be sown from $\frac{1}{2}$ to $\frac{3}{4}$ inch deep, making the bed firm, but not tight. The beds should be kept shaded and just moist. Too much wet will cause the young seedlings to damp off, and if allowed to get too dry the germs will quickly dry up and die.

"We have been most successful when the seed has been sown in boxes (made of $\frac{1}{2}$ inch wood) 18 by 13 by $3\frac{1}{2}$ inches, filled with the kind of soil described above. The boxes are handy to lift about, and can be easily protected from heavy rain and strong sun. Sheds made after the style of the old cinchona seed sheds answer well for standing the boxes in, and if made light and airy would do well to sow the seeds in direct, but care should be taken not to allow the young plants to be 'drawn.'

"We find it a good plan to prick out the seedling into supply baskets as soon as they are large enough to handle comfortably, or transplant them into beds, placing the plants 6 inches apart every way, and keeping them shaded and watered until they begin to grow, when they will bear the full light of the sun, but will require to be freely watered in dry weather.

"When the plants are from 9 to 15 inches high they are at their best for final planting, but if the weather is unsuitable they may be kept in the nursery till they are 2 feet high, or until good planting weather occurs viz., dull showery weather. In such weather they require very little shading, and soon take hold of the soil.

"Cuttings do not strike root readily, and only under certain conditions will they be successful. If the prevailing weather should be too dry they soon go off, and if too wet and cold they decay before roots are formed. We have had batches of cuttings with 70 per cent. beginning to callus over, and young shoots forming, that have gone off after three or four days of rough weather—cold high winds and heavy rains—and others that have gone the same way after a week of dry sunny weather. The favourable conditions are equable heat, light, and moisture; with these, and wood for cuttings in a proper state, a large percentage will strike root and make good plants.

"The nursery beds for seeds as well as cuttings should be made in a well-drained situation, and as near water as possible. The beds may be any length, and from 3 to 4 feet wide. The soil for cuttings should be composed as follows: one part good sandy

loam, one part leaf mould, and one part clean sharp sand (to this it would be beneficial to add a good sprinkling of powdered charcoal), all thoroughly mixed. The soil should be 6 to 9 inches deep. A layer of good sharp sand one inch thick should be laid on the surface. As a protection against hot sun and heavy rains it would be well to put a roof of thatch over the beds in the form of a shed but it should be constructed with open sides to allow plenty of light and air. A shed 4 feet wide, with a lean-to roof on stout posts, open at the back and front, will be found a useful size. The posts should be 6 feet high in front and 3 ft. 6 in. at the back. The roof may be thatch, shingles, or other light material. If more than one is required, a space 4 feet wide should be left between the sheds to give room for watering, weeding, and general attention.

"The best material for cuttings is that from straight, healthy, and well matured shoots of the current year's growth, not too soft or too hard. If too hard they will not root readily, and if too soft they will be liable to damp off. The cuttings may be of any size from the thickness of a lead pencil to $\frac{3}{4}$ inch in diameter. They should be cut into lengths of from 6 to 9 inches. A clean cut with a very sharp knife immediately below a joint to form the base of the cutting is of the greatest importance. If the cut portion is torn or jagged, or too far away from the joint, it is almost certain to decay, though it may remain green for a long time.

"The operation for inserting the cuttings is best done by opening a trench with a sharp spade so as to form a straight edge. The prepared cuttings should be laid against this and the soil pressed firmly round them. They should be placed in rows 9 to 12 inches apart and 3 inches apart in the rows, and at a sufficient depth to leave only two or three buds above the surface.

"The sooner the cuttings are made and put in after being taken from the trees the better. After the cuttings are put in, the beds should be watered to settle the soil, and if in the open, they must be carefully shaded and sunlight must be only gradually let in as they become rooted and can bear it. If all goes well they should be rooted in 2 to 3 months, but they will not be ready for planting out for three or four months.

"Camphor may also be propagated by layers. The operation of layering is very simple. The shoots should be bent down to the soil. The branch at the bend should be cut half-way through, then cutting upwards for about $1\frac{1}{2}$ to 2 inches, so as to form a tongue. The cut portion must be kept apart by a slight twist, or by placing a piece of brick or a small stone in the cleft. The shoot should then be pegged down firmly into a groove made in the soil for its reception and covered with soil. The end of the shoot must be kept upright by tying it to a stick.

"Another simple way is to split the branch at the bend where it is to be laid in the ground, making the split about 2 inches long, and keeping the cut parts open by inserting a piece of wood or stone. Peg down well into the soil and stake. The ends of the shoots should be cut back a few inches with a sharp knife."

It is thus evident that the plant will thrive almost anywhere in the Island if the water supply be sufficient and the soil well drained. The best method of treatment is probably to grow it as hedges, which are easily managed and clipped. It may also be planted along roads, jungle edges, &c., but *should never be mixed with the tea*, as the young leaves are very like those of tea, and a twig or two of camphor will spoil a whole break of tea.

The following analyses of two soils at Hakgala—on one of which (A) camphor does very well, on the other (B) only moderately—will help to guide to the selection of suitable spots :—

CAMPBOR SOILS.

"Six samples of soil were received from Mr. Nock at Hakgala, which represented the character of the soil and sub-soil, where camphor trees grew well and only fairly well.

"No. 1 A, represents a section 15 inches deep between trees showing the best growth, viz., 20 to 25 feet high and 12 to 15 feet in diameter at five years and nine months from the time of planting. The surface soil here is about 1 foot deep. It is composed of agglomerated particles of dark brown colour and yellow fragments of decomposing gneiss. It is very rich in nitrogen and the lower oxide of iron, has a fair amount of lime, but is deficient in potash and phosphoric acid.

"No. 2 A, representing the upper 6 inches, is of a dark brownish colour when dry, and is almost entirely composed of the agglomerated particles mentioned in No. 1 A and rootlets, &c. The analysis shows it to contain the bulk of the nitrogen, and an excess of the lower oxide of iron, but it is deficient in potash and phosphoric acid.

No. 3 A, represents the sub-soil at 15 inches deep or 3 inches below the actual surface soil. It is composed of yellow pieces of decomposing light-coloured gneiss, more or less bound together with a clayey matrix. It also contains a fair amount of nitrogen and rather more phosphoric acid and potash than the surface soil, and would be fairly easily penetrated by roots.

"No. 1 B.—This is taken from a section 15 inches deep, where the camphor is only doing fairly well. The plants five years and nine months old are from nine to ten ft. high and 6 to 8 ft in diameter. It is more finely divided than No. 1 A, and is of a lighter brown colour. Chemically, it is also somewhat poorer, though containing a good amount of nitrogen. Lime and mineral plant food generally may be considered deficient, especially potash, and this no doubt accounts for the poorer growth of the camphor trees in this part.

"No. 2 B, representing the top 6 inches, is a dark coloured loam, somewhat richer in nitrogen and phosphoric acid than No. 1 B, but is very poor in lime, magnesia, and potash.

No. 3 B, representing the sub-soil 15 inches from the surface, is a yellow loam much more finely divided than No. 3 A, but otherwise of somewhat similar composition. When wet it is of a retentive clayey nature requiring drainage.

HAKGALA, NUWARA ELIYA.

ANALYSIS OF SOIL (CAMPHOR).

Mechanical Composition.

		No. 1 A. Per cent.		No. 2 A. Per cent.		No. 3 A. Per cent.
Fine soil passing 90 mesh	...	20.00	...	26.00	...	34.00
Fine soil passing 60 mesh	...	15.00	...	24.00	...	18.50
Medium passing 30 mesh	...	7.00	...	5.00	...	7.50
Coarse sand and small stones	...	58.00	...	45.00	...	40.00
		<u>100.00</u>		<u>100.00</u>		<u>100.00</u>

Chemical Composition.

		No. 1 A. Per cent.		No. 2 A. Per cent.		No. 3 A. Per cent.
Moisture	...	5.100	...	5.000	..	5.900
Organic matter and combined water	...	14.500	...	17.700	...	11.500
Oxide of iron and manganese	...	8.200	...	7.080	...	9.800
Oxide of iron and aluminum	...	11.346	...	7.575		10.000
Lime	...	.140	...	.124	...	.050
Magnesia	...	.072	...	.075	...	.020
Potash	...	.030	...	.011	...	.061
Phosphoric acid	...	.012	...	.035	...	.069
Sand and silicates	...	60.600	...	62.400	...	63.000
		<u>100.000</u>		<u>100.000</u>		<u>100.000</u>
Containing nitrogen	...	.308	...	.490	...	.182
Equal to ammonia	..	.374	...	.595	...	.221
Lower oxide of iron	...	Good	...	Much	...	Fair

Mechanical Composition.

		No. 1 B. Per cent.		No. 2 B. Per cent.		No. 3 B. Per cent.
Fine soil passing 90 mesh	...	25.00	...	17.50	...	47.50
Fine soil passing 60 mesh	...	23.00	...	16.50	...	26.50
Medium soil passing 30 mesh	...	8.50	...	6.50	...	5.00
Coarse sand and small stones	...	43.50	...	59.50	...	21.50
		<u>100.00</u>		<u>100.00</u>		<u>100.00</u>

Chemical Composition.

Moisture	...	5.100	...	5.100	...	5.800
Organic matter and combined water	...	11.900	...	15.500	...	11.400
Oxide of iron and manganese	...	8.000	...	8.200	...	8.520
Oxide of iron and aluminum	..	9.210	..	8.050	...	12.502
Lime	...	.080	...	.060	...	.040
Magnesia	...	.070	...	.014	...	.046
Potash	...	.015	...	.007	...	.054
Phosphoric acid	...	0.25	...	.069	...	.038
Sand and silicates	...	65.600	...	63.000	...	61.600
		<u>100.000</u>		<u>100.000</u>		<u>100.000</u>

Containing nitrogen	...	·259	...	·371	...	·128
Equal to ammonia	...	·314	...	·450	...	·156
Lower oxide of iron	...	Fair	...	Much	...	Trace

“The ash of the camphor leaves was analyzed to determine the constituents most required by their growth. The leaves contained—

				Per cent.
Water	...	...	...	74.32
Organic matter*	...	...	...	19.58
Ash	...	...	...	6.10
				100.00

*Containing nitrogen 1.47 per cent.
Equal to ammonia 1.78 “

<i>Composition of Ash</i>				Per cent.
Lime	...	...	...	32.90
Magnesia	...	...	...	6.48
Oxide of iron	...	...	...	2.00
Alumina	..	...	...	3.11
Potash	...	...	...	14.86
Soda	...	...	...	4.21
Phosphoric acid	...	...	...	2.16
Sulphuric acid	...	...	...	2.00
Sand and silica	...	...	...	1.20
Carbonic acid	...	...	...	26.10
Carbon and undetermined	...	...	...	4.98
				100.00

“The chief mineral ingredients required by the camphor plant for the growth of leaves are lime and potash, an average yield of prunings removing 196 lb. of lime and 87 lb. of potash, which could be returned to the soil after the distilled wood had been burned for fuel purposes.

“M. KELWAY BAMBER, F.C.S., &c.”

PREPARATION OF THE CAMPHOR.

As soon as the plants have reached a fair size and formed stout woody stems below—say in three years or less in very good situations—they may be clipped. The simplest method will perhaps be to use hedge shears, placing a long basket below the hedge to catch the clippings. Only the leaves and young twigs are required; woody twigs yield little or no camphor.

In Japan, where however, they only use the wood of full-grown trees as a source of camphor, the chips of wood are distilled in a primitive-looking but effective still, with bamboo tubes (these have the advantage that they can afterwards be split to remove any camphor from them) and a wooden condenser with water running over its lid. In Ceylon probably the best method will be to fix up

a small still of any good pattern with a glass condenser and plentiful water supply, working it by means of steam from the factory boiler. As the distillation is a somewhat uncertain operation, especially to the beginner, and as it is probable that more efficient methods will be discovered, the details of the principal experiments tried are given below. Material for these experiments was obtained from the gardens at Peradeniya (1,600 feet), Hakgala (5, 600 feet), and Anuradhapura (300 feet).

CAMPBOR DISTILLATION.

The first distillations were from 112lb. of prunings received from Hakgala on the 28th June, 1900. These were conducted in a large cask fitted with a metal cover leading to a metal condenser which was cooled by a constant flow of water. Distillation was effected by means of steam from a boiler, passing into the lower part of the cask below a perforated iron plate. The prunings were chopped up into fragments about 1 inch long, covered with water, the top, connected with the condenser, luted on, and steam turned on to gradually bring the water to the boil.

A strong pungent smell of camphor and eucalyptus came off as soon as distillation commenced, which persisted for some time even when the distillate was cooled to 50° F., a temperature below that which could be obtained practically. The loss was minimized by bringing the water to the boil very slowly, and only admitting just sufficient steam to keep it at the boiling temperature. It was found that the metal cover to the cask retained a good proportion of the camphor, but it was not so pure as when condensed in a wooden box similar to that in use in China and Japan. The purest camphor was obtained when the distillate was made to pass through a long glass tube surrounded with a jacket of cold (running) water, the crystals being deposited when the temperature of the glass did not exceed 50° C. or 122° F., a temperature that could easily be maintained in a condensing apparatus up-country at all times of the year. In the low-country a more rapid flow of condensing water and a proportionately longer condensing apparatus would be required to obtain the same results, as the water is much warmer and the steam also is at a higher temperature.

In all the experiments the camphor had almost entirely distilled over during the first three hours, as several distillations conducted for twelve hours and longer resulted in no better yield, and the smell of the camphor under these circumstances was contaminated with that of decomposition products from the nitrogenous matter, &c., in the leaves and twigs. Three distillations could be made in the same apparatus during the day.

The amount of steam required for the distillation even of large quantities would be nominal, and would hardly be felt in an ordinary boiler working in a tea factory.

YIELD OF CAMPBOR.

The first distillation from part of the prunings obtained from Hakgala in June, 1900, only yielded 35 per cent., but this was

increased to '62 per cent. by better regulation of the steam pressure and the condensing water. The camphor had a slight smell of eucalyptus, and was not so strong as ordinary camphor. The leaves were quite fresh when distilled.

Separate distillations were again made in August with fresh leaves and twigs, and the green branches of about half inch to 1 inch thick the former yielded '85 per cent. camphor, but the latter a mere trace, both of camphor and oil.

7th September, 1900.—Three distillations of camphor leaves from Peradeniya were made in the usual manner, the yield from the first being 1'10 per cent. of camphor and camphor oil. In the second distillation, when the leaves had partly dried, 1'06 per cent. of camphor and oil was obtained, calculated on the fresh leaves. In the third distillation the leaves had undergone partial decomposition, the result of becoming heated to a temperature of 106° F. The yield in this case was '68 per cent. camphor and '38 per cent. of oil, so that it would appear advisable to distil the leaves as fresh as possible, as the oil is less valuable than the camphor.

9th October, 1900.—A sample of young camphor flush weighing 11½ lb. plucked from two trees in Hakgala, one 8 feet in diameter and 12 feet high, yielding 8 lb., and the other 5 feet in diameter and 7 feet high, yielding 3½ lb. This was carefully distilled in a copper retort over a lamp, and the vapour condensed in a glass vessel. In the first four hours '63 per cent. of pure camphor was obtained, which smelled only of pure camphor; on further distillation '08 per cent. more camphor was obtained, which did not smell quite so pure. Heating by the direct flame beneath the vessel appears to take longer in removing all the camphor than driving it over with steam under slight pressure.

24th October, 1900.—A distillation of camphor clippings from Hakgala yielded .77 per cent. camphor and '27 per cent. oil.

30th October, 1900.—A distillation of 12 lb. of camphor flush was made in a copper vessel with a glass condenser, yielded '69 per cent. camphor and '34 per cent. camphor oil. The trees were in active growth when this flush was plucked.

9th January, 1901.—A camphor tree that had become slightly cankered was received from Hakgala in separate parcels of leaves, branches, stem, and roots. Several distillations of the leaves and twigs were made both in the fresh state and when air-dried, some of them being continued for twelve hours. The yield of camphor and oil varied somewhat, but appeared to depend on the proportion of leaves to twigs, the latter containing much less than the former. A glass condenser was employed for all these distillations, the camphor and oil being obtained quite pure.

The first experiment yielded '875 per cent. camphor and '986 per cent. oil, a far larger proportion of oil than in any previous distillation of similar leaf.

A second distillation, which was continued at a low temperature for eleven hours, yielded 1'08 per cent. pure camphor and 0'32 per cent. oil.

Five other distillations at intervals of some days with the air-dried leaves gave the following yields :—

- No. 1.—2.310 per cent. camphor and .114 per cent. oil, equal to 1.02 per cent. on fresh leaf.
- No. 2.—2.149 per cent. camphor and oil, equal to .98 per cent. on fresh leaf.
- No. 3.—2.425 per cent. camphor and traces of oil, equal to 1.05 per cent. on fresh leaf.
- No. 4.—2.31 per cent. camphor and traces of oil, equal to 1.01 per cent. on fresh leaf.
- No. 5.—2.081 per cent. camphor and traces of oil, equal to .96 per cent. on fresh leaf.

From these figures it will be seen that air-drying the leaf before distillation does not cause any appreciable loss of camphor, though a certain amount of oil disappears, either by volatilization or oxidation. The camphor obtained from the air-dried leaf also had a somewhat purer smell than that from the fresh leaf, though this latter was easily rendered pure by re-distillation with steam.

Three distillations were made of the branches and stem of the camphor tree, but no appreciable quantity of camphor was obtained from either, nor did the bark of the stem appear to contain more than traces. The roots, however, contained an oil, 5lb. of roots yielding 1.22 per cent. This oil was located mainly in the bark and in a thin layer of wood beneath it. It had only a slight smell of camphor, and more resembled a mixture of aniseed and peppermint.

On the 7th August, 1901, 5lb. of young flush was received from Hakgala in a slightly heated condition. It was at once put into a copper vessel with fifteen pints of water, and a glass dome luted on, which was connected with a glass condenser. The water was heated slowly from below, and a thermometer placed, so as to register the temperature of the vapour 2 inches above the water and camphor leaves.

At 50° C. (122° F.) crystals of camphor condensed on the glass dome, which at 90° C. (194° F.) were carried back into the water by the condensed steam. At 100° C. the steam and camphor vapour was passing rapidly into the glass condenser, while the leaves were covered with oily drops of camphor and oil. Distillation at 100° C. was continued for two hours, when 4½ litres (7.93 pints) of water containing camphor and oil had collected in the condenser. This was then passed through a wet paper filter to separate the camphor and oil from the water, 24.53 grams of the mixture being obtained, equal to 1.10 per cent. The oil was separated from the camphor as much as possible, the yield of each on the original flush being .755 per cent. pure camphor and .345 per cent. camphor oil. Another distillation was made in the same way of 10lb. of coppice shoots one year old from a tree that had been cut down. The yield of camphor from this was very small, only .192 per cent. and shows that the first year's growth from a tree cut down to the ground is practically valueless, but it is probable that young flush from such coppiced trees would increase in the camphor contents during the next and succeeding years.

Further distillations were also made of the entire prunings

weighing 50lb. of a five year and nine months old tree of average growth, the leaves (27lb.) and branches (23lb.) being distilled separately, the former yielding 767 per cent. of pure camphor and some oil, the latter only traces of oil, showing that the whole of the camphor is practically in the leaves and not in the young wood. The reason of this should be investigated, as it is from *old wood* that the bulk of the camphor of commerce is obtained.

CHARACTERS.

The camphor obtained from all the above experiments has the usual crystalline form, and is perfectly colourless unless condensed in an iron vessel, when it is tinged with red from the oxidized iron. It floats on water, in which it is almost insoluble, and small fragments rotate rapidly when floated on this liquid. It burns with a yellow smoky flame, leaving no residue, and volatilizes readily at the ordinary temperature. It is easily soluble in alcohol, ether, and chloroform, and is precipitated from the former in white flocculent masses, when the solution is poured into water. It sublimes readily, and has an odour of camphor, but not so powerful as ordinary camphor from old wood. Its specific gravity is .987; it melts at 175° C., (347° F.) and boils at 205° C. (400° F.). It dissolves readily in nitric acid, with some development of heat, and immediate separation of the solution into two layers, the upper of a red colour and the lower pale yellow or colourless. The addition of water precipitates the camphor as a white mass from the upper layer of the solution apparently unchanged.

SUBLIMATION EXPERIMENTS.

These were conducted at varying temperatures and under different conditions in order to try and obtain the translucent state common to commercial camphor. The most successful method was by mixing the crude camphor with slaked lime in the proportion of 40 to 1, and subjecting this in a closed vessel to a low heat for twelve hours, the heat being gradually increased up the sides of the vessel in order to drive all the camphor into the upper portion. Copper vessels are the best for the purpose, as glass is liable to fracture from condensed moisture running down to the heated sides.

Before sublimation can be effected it is essential that all the camphor oil should be expressed from the camphor. The camphor when first distilled appears to be practically free from oil, but after standing some days oil gradually separates and sinks to the bottom of the mass of crystals, and this appears to continue for months. Filtration with the aid of a vacuum effects a partial separation, but in practice on a large scale it would be best effected by means of a centrifugal machine similar to that employed for the separation of crystalline sugar from molasses.

OIL.

The oil obtained with the camphor from the leaves is of a clear yellow colour, having a specific gravity at 80° F. of .9662. It con-

tains a certain amount of camphor in solution, which can be separated to some extent by cooling to 10° C. It would therefore be advisable to cool the mixture of camphor and oil, as much as possible, before submitting it to centrifugal expression.

The root oil, of which 1·22 per cent. was obtained from the air-dried roots, was almost colourless, and had no smell of camphor. It consisted of a mixture of two oils, one lighter and one heavier than water, the specific gravity of the mixed oils being 1·058 at 80° F.

YIELD AND PROSPECTS.

The figures above given show that the yield varies a good deal, but that on the average about .75 to 1 per cent. of camphor may be expected from the young leaves and twigs, as well as a small quantity of camphor oil, which also has a market value. Samples of camphor mixed with the oil were valued lately at Rs. 126 per cwt. If we assume that clippings will yield about 1 per cent. of camphor and oil worth Re. 1 per lb., we should be well within the mark. The cost of obtaining this should be about Rs. 53 per acre, made up as follows:—

Pruning 1,210 trees and carrying to factory	Rs. c.
Distilling, fuel, packing, &c. ...	37 0
	16 0
	53 0

I. e., camphor can be put on the market as cheaply as tea per pound if the yield be at the rate of 177 lb. per acre (cost of tea being estimated at 30 cents.) Now 177 lb. will be yielded by 17,700 lb. of clippings. In the case of bushes 6 feet apart this means 14½ lbs per bush per annum, or about seven times the weight of flush obtained from a prosperous tea bush. On the other hand, the bushes are only half as many to the acre, and the plucking is much coarser, so that this estimate is not unreasonable, and the product is more valuable than tea. It seems not unreasonable to expect that where a bush, with 36 square feet of space to grow in, yields 12 to 15 lb., of clippings a year, the cultivation will prove remunerative—not a bonanza, but yielding a fair profit. In Hakgala Gardens this yield is exceeded, so far as rough experiments show.

PARIS GREEN: APPLICATION TO COTTON.

*Mr. Wm. B. Seabrook to Director, Public Gardens and Plantations.**
James Island, South Carolina,
U. S. A., February 21st, 1906.

My Dear Sir,

I remember the interest you took in the appliance used for applying Paris Green to the cotton plant for destroying caterpillars. I am now trespassing upon your time to give you some further information on this subject. Last summer there was introduced a

* For previous letter by Wm. Seabrook on Paris Green, see Bulletin July, 1904, page 159.

small kind of bellows, called a "powder gun," with long handles, and the nozzle terminating in a little fixture like the sprinkling nozzle of a watering pot. The Paris Green powder is put in a receptacle in the bellows, the nozzle is put in the middle of the cotton bush, a very slight convulsive movement of the bellows handle—that is all. The little puff of powder that is blown out is so slight that it is hardly possible to see it, pump it out until you can see it, and you will be sure to burn up the cotton. It is the simplest to operate of any contrivance yet devised ; is more efficacious in its deadly work on the worm, and the most convenient to handle. When I wrote to Sir Daniel Morris about it, he immediately asked to be put in communication with the manufacturers, looking forward to obtaining a supply another season, should they be needed. While instructing them to send him one of their catalogues I took the liberty of instructing them to send one to you too. I hope you will get it safely.*

My thoughts are full of pleasant memories of Jamaica—beautiful Island—and of the pleasant acquaintances made, and friendships enjoyed during my brief stay there. I remember with kindest interest Mr. Fursdon and Mr. Sharp, who were very kind to me. Give them my kindest regards, should you see them.

I am very sincerely and truly yours,

WM. B. SEABROOK.

BOARD OF AGRICULTURE.

EXTRACTS FROM MINUTES.

The usual monthly meeting of the Board of Agriculture was held at Headquarter House on Wednesday, 16th May. Present: The Hon. H. Clarence Bourne, Colonial Secretary, in the chair, the Director of Public Gardens, the Island Chemist, His Grace the Archbishop, the Superintending Inspector of Schools, Messrs. C. E. DeMercado, J. W. Middleton, G. D. Murray and the Secretary.

Standard for Jamaica Rum.—The Secretary read letter from the Colonial Secretary's Office stating that the Governor was not prepared at the present moment to prescribe a standard quantity of ethers for Jamaica rum.

The Secretary also read a letter from the Secretary of the North-side Sugar Planters Association stating that it was the opinion of the Association that any law to standardise Jamaica Rum was unfortunate and likely to deal a stiff blow against the rum industry.

He also submitted the papers giving the Chemist's arguments in favour of standardisation and the criticism of members of the Board.

He was directed to reply to Mr. Shore informing him of the Governor's decision regarding standardisation.

Agricultural Don'ts.—The Secretary read a letter re "Agricultural Don'ts" from the Colonial Secretary, stating that when next year's estimates were under consideration the amount required for printing the charts of "Agricultural Don'ts" might be submitted for con-

* One of these powder guns is now in use, and can be seen at Hope Gardens.

sideration under Agricultural Vote. Also letter from the Education Department stating that the Board of Education was willing to recommend that the chart be placed in schools if the Board of Agriculture was willing to print it.

Commercial Agent in London.—The Secretary read a letter from the Colonial Secretary on the matter of the appointment of a Commercial Agent in London, stating that the Governor had consulted the Privy Council on the matter and they had advised that the rule laid down by Mr. Chamberlain when Secretary of State should be followed, viz.: that such an Agent should be appointed and maintained by the commercial community in the Colony and be entirely unconnected with the Government, though there would be no objection to the Government making if necessary, and the Legislative Council was willing, a small grant to some such body as the Royal Jamaica Society of Agriculture and Commerce if that Society were willing to take the matter up, but on a previous occasion when this decision was intimated to that Society, the Secretary replied that its funds were unable to stand the expense and they desired the Government largely to increase its suggested grant. This the Government was unable to do. It remained for those interested to make some arrangements whereby the funds necessary for carrying out their suggestion be provided by those likely to profit most by the Agency.

Sugar Grant.—The Secretary submitted copy of Law 3 of 1906 entitled "A Law in aid of Law 45 of 1903" to give the Board of Agriculture, with the sanction of the Privy Council, a wider discretion as to the expenditure of the £10,000 therein mentioned, in the interest of the sugar industry.

Demerara Rums.—The Secretary submitted a copy of the Official Gazette of British Guiana, also an extract from the Demerara Argosy showing the variation in the contents of ethers in Demerara Rums which ranged from 30.1 to 122.7.

Truck System.—The Secretary submitted a private letter, referred by the Governor, where complaint was made of a practice found prevailing on the writer's estate and others, of overseers supplying bread, beef and pork to the labourers and stopping the cost of it out of their wages when they were charged for more than they got, and that they did not get work unless they agreed to purchase these things. The writer suggested that there should be a law here similar to the Truck Act in England to prevent this.

After discussion in which it was said that there were very few estates where this practice would be carried on, it was resolved to refer copies of the letters to the Westmoreland and Northside Sugar Planters Associations for their remarks.

Cotton Seed.—The Secretary read letters from the Imperial Department of Agriculture calling attention to the importance of using the Department's selected and disinfected Sea Island Cotton seed.

It was stated that matter on the subject was being published in the *Bulletin* and in the *Agricultural Journal*.

Leave for Mr. Cousins.—The Secretary submitted a letter from the Colonial Secretary's Office stating that Mr. Cousins had ap-

plied for leave of absence for three months from the 23rd July next and proposed that the Assistant Chemist should act as Government Chemist and manage the routine work of the office, while the Fermentation Chemist should be placed in charge of the Sugar Department and act for Mr. Cousins on the Board of Agriculture, and asking him to ascertain from each member of the Board whether there was any objection to the proposed arrangements.

The Secretary stated that none of the members of the Board had had any objection to offer and the Governor had accordingly granted leave to Mr. Cousins.

Chemist's Reports. The Secretary submitted Reports of the Chemist as follows :—

1. Applications from Distillers to attend special Course. This was referred to the Advisory Committee of Sugar Experiments.
2. Work of Agricultural Students for Easter Term. This was directed to be circulated.

Director Public Gardens' Reports. The following reports from the Director of Public Gardens were submitted :—

1. Hope Experiment Station.
2. Instructors—Mr. Cradwick and Mr. Briscoe. These were directed to be circulated.

Lecturer in Agricultural Science and Assistant Chemist. The following paper which had been circulated but had not yet been before the Board was submitted :—

1. Letter from Mr. Cousins recommending Mr. E. J. Wortley to fill the appointment of Lecturer in Agricultural Science ; and stating that the best plan for filling the post of Assistant Chemist would be to offer a salary of £220 rising to £240 by annual increments of £10 through the Crown Agents on a three years' agreement, the funds to be provided as follows :—

Present salary of Assistant Chemist £150 to £200 by £10, salary of Assistant in Sugar Laboratory (vacant) £70.

It was agreed that this latter recommendation should be adopted. A letter was submitted from the Colonial Secretary intimating that Mr. Wortley had been appointed in Mr. Teversham's place.

The following papers which had been circulated were now submitted for final consideration :—

1. Re Standardisation of Jamaica Rum.
2. Proposals as to Distillers' Course.
3. Report on the successful working of the high ether Installation at Hampden Estate.
4. Distillery Progress in Westmoreland.
5. Appropriation Accounts, Government Laboratory and Sugar Experiment Station for 1905-06.
6. Reports Instructors.
7. Report Hope Experiment Station.

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BULLETIN

OF THE

DEPARTMENT OF AGRICULTURE.

Vol. IV.

JULY, 1906.

Part 7.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.,

Director of Public Gardens and Plantations.

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P R I C E—Threepence.

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Part 7.

A MEXICAN RUBBER PLANTATION.*

We have received particulars about the fine La Zacualpa rubber plantation in Mexico, of the Hidalgo Plantation Co., in an interesting pamphlet entitled "Rubber: what it is and how it grows," by the general manager of the company. This is the second edition of the pamphlet, (which is illustrated from photographs), and in his foreword the author says: "Since the first edition was issued, rubber has advanced in price, with every prospect of its going higher, and the attention of the business world is more than ever turned to this profitable industry. This book is dedicated to the young people of our public and private schools, with the hope that the matter it contains will be found interesting as well as instructive."

The first part deals with rubber generally, but here we only quote some particulars about La Zacualpa estate, which show how a big rubber estate in Mexico is run, and give information of use to planters of *Castilloa elastica*,

LA ZACUALPA RUBBER PLANTATION.

La Zacualpa rubber plantation is, without doubt, the foremost of its kind in Mexico, and for depth of soil, requisite rainfall, systematic drainage and intelligent management has not its equal in the world. It is situated between the towns of Huistla and Es-cuintla, about 20 miles from the Pacific Ocean, and near the Pan-American railroad which is to connect Tapachula with the Tehuantepec railroad at San Geronimo. This road has already reached Tonalá, and will be pushed through to completion under a most favourable concession from the Mexican Government. The planted trees are easily accessible at all points by avenues running for miles; seven of these have already been named, as follows: Harrison avenue, Van Court avenue, Alicia avenue, Butler avenue, San Carlos avenue, La Reina avenue, Santa Helena avenue. These are crossed by streets that are numbered, and the

* From "Ceylon Observer."

visitor can ride for miles through groves of healthy rubber trees, the branches of the older trees arching overhead. At the present writing some 8,000 acres are planted.

CASTILLA LACTIFLUA.

In a letter received from Mr. O. F. Cook, of the Agricultural Department, Washington, he says: "You will doubtless be interested to know that I have recently described the Soconusco rubber tree as a distinct species under the name *Castilla lactiflua*. The Castilla of the Soconusco District of the State of Chiapas ("C. lactiflua"), is peculiar in having the complemental inflorescence flattened and with a broad mouth; it is very similar to the primary, except in the smaller size. The specific name alludes to the fact that the milk of the tree flows freely when the bark is cut, so that it can be collected in quantity and coagulated by improved (creaming) methods, instead of the rubber being harvested wholly or partly by pulling the 'scrap' (*burucha*) from the gashes in which it has dried."

The Department (or County) of Soconusco, in the state of Chiapas, one of the twenty-seven States forming the Republic of Mexico, is the natural home of the *Castilloa elastica*, or Mexican rubber tree, as is proven by the great number of wild rubber trees which grow spontaneously in its forests. In their wild state they grow tall and lank, reaching a height of over fifty feet and a diameter of twelve to eighteen inches.

As far as known the trees are long-lived, and increase their output of latex yearly until as many as twenty-five pounds of crude rubber have been taken from a single tree. It is only within a few years that attention has been called to the cultivation of this tree. During the years 1889 and 1890 a grove of some 5,000 of these trees was planted on La Zacualpa, a plantation in the above Department, which trees are now (1905) on an average, eighteen inches in diameter and forty feet in height, and are yielding about two and one-half pounds of rubber to the tree.

They stand about 400 to the acre, and are in prime condition. These are the trees referred to by Mr. O. F. Cook, Bulletin 49, issued by the United States Department of Agriculture, as follows: "The planted trees at La Zacualpa abundantly demonstrate the practicability of rubber culture."

The successful production of rubber and growth of these trees, combined with their present healthy state, has proved the fact that *Castilloa elastica* can be easily cultivated in its native habitat, with large profits. Cultivated trees are raised from the seed, and begin to yield milk during the sixth year from date of planting. The trees have no natural enemies, as by reason of the quantity of resin and albuminoids contained in the milk, they are not molested by worms, insects, birds or animals.

Owing to the successful conditions noted above, this plantation has been extensively developed, and under the care of expert rubber cultivators about 3,000,000 rubber trees are growing vigorously. The cultivation of rubber is a new enterprise, calling for the most

careful study, and is a notable addition to the world's varied industries. Consequently, the questions of soil, rainfall and climatic conditions must enter largely into the calculations of those contemplating its future.

The rubber tree requires a rich loam soil ; warm, moist climate ; low altitude ; a large and evenly distributed rainfall, and perfect drainage. All these conditions exist in the Department of Soccosusco.

The rain record, taken daily by the British Vice-Consul, R. O. Stevenson, has averaged 160 inches for many years past.

The plantation consists of 18,791 acres of land, of which 12,000 acres have been set apart as La Zacualpa Rubber Plantation and are now being planted with rubber trees.

LABOUR.

The management is entrusted to one superintendent, two major-domos, or sub-managers, and one corporal to every thirty men. During the planting season about 300 men are employed, with ten corporals. All the planting is done under the supervision of rod-men who have formerly worked with engineers, and the lines outlining the planted squares and avenues between are run with great care. At sunrise the plantation bell calls the labourers to work, all assembling in the patio, or yard, in front of the manager's house. The major-domos receive their instructions from the manager and communicate them to the corporals, who in turn direct their men regarding the work of the day, and are responsible for the performance of their respective duties. The bell, which can be heard in all parts of the plantation, announces the noon hour, and at 1 o'clock work is resumed, continuing till sunset. Everything is done in the most systematic manner, and the plantation is kept clean and in good order at all times. The supplies needed are furnished from the company's store, and a large bake oven is provided for the use of the labourers. Generally four or five women do all the baking, and sell bread to those wishing to buy.

THE LOCATION OF THE PLANTATION

is an ideal one, level for the most part, but sufficiently rolling for good drainage, well watered, entirely free from stones and gravel, and has the reputation all through that country of being a very choice strip of rubber land. The elevation at no point exceeds 400 feet, and at some places is as low as 100 feet. La Zacualpa Rubber Plantation is a most interesting place, and improvements are constantly being made. A sawmill is in constant use, preparing timber for the construction of permanent houses for the native labourers and other buildings for the company's use. Excellent tiles have been made from clay found on the plantation, and are used in roofing buildings. The population of La Zacualpa today, including men, women and children, is over 600. The same plan has been carried out in the buildings for the labourers as that used in the plantation proper, the buildings being situated on plazas, or squares.

THE CASTILLOA ELASTICA TREE.

The *Castilloa elastica*, or Mexican rubber tree, is between five and six years old when it blooms. Before blooming the tree sheds its leaves. The blossoming season begins in January and continues until April. Clusters of small, whitish blossoms first put forth, and three weeks later the tiny petals fall, leaving a little green centre which gradually enlarges, and is filled with seed points sticking fast to a round disc. The blossoms are as numerous as the leaves, and each one has at least twenty seeds about the size of an ordinary pea. When the blooming and seeding time is over the trees put forth new leaves.

SEEDS.

The seeds are encased in a shell which is hard while green, but it soon softens into a sticky substance like fish gelatine. The first turning in the ripening process is to a sickly yellow, which gradually changes to a bright red. As soon as the seeds are ripe, with the first rains they begin to fall. This is a busy time on the plantation. The seeds literally cover the ground underneath the trees, and the labourers gather them into sacks and carry them to the nurseries. There they are dumped into pails filled with water and washed thoroughly to detach them from the discs and rid them of the enveloping gelatine substance. When the seeds have been ripe sixty days they will no longer germinate, and to get the best results should be planted immediately after washing, which is done to facilitate handling and prevent them from germinating in the gelatine coating.

PLANTING.

There is some difference of opinion among planters as to the best methods of planting, some advocating partial shade, and again some would plant from a nursery previously formed, and others with the seed at stake. Difference of local and climatic conditions is no doubt the cause of this diversity of opinion, as each section calls for different methods. The method adopted on La Zacualpa, and that which has been productive of the best results in that locality, is the following:—

The land is first surveyed into squares of thirty-three acres each, which includes avenues and roads twenty-four feet wide between them. The roads run in straight lines, and are cleared of all trees and shrubs, thus making them available for the use of the workmen and inspection of the plantation. The roads running north and south are called avenues, and those east and west streets, the former being named and the latter being numbered. The roads are now several miles long, and in order to facilitate transportation of the labour to various parts of the plantation, the Company is about to put in a small electric railroad. The land is cleared by cutting down the forest and is then burnt off. Some of the largest trees are left, and most of them escape the fire and send out new foliage, which then acts as partial shade to the young trees. After the burning the land is then staked out to

allow for 400 trees to the acre. A small mound of earth is made at each stake, and the rubber seeds are imbedded therein.

The seed will germinate in from eight to fifteen days, and one month from the time of planting the plant attains a height of about eight inches, and its growth from this time on is rapid and may roughly be put down as one foot per month. Our three-years-old trees are over thirty feet high, and those of four years about thirty-five feet. After the planting has been done, great care is taken that the forest growth does not choke out the young tree. This growth is kept down continually, thus giving the young rubber tree a good start until it is able to take care of itself, which it can do two years after planting, after which time it requires very little attention.

TAPPING METHODS.

The native Indian method of tapping is as follows :—Before beginning to tap, a place is selected on the tree, preferably on the inclined side, and a hole made in the ground below, lined with a wide green leaf. The tapper makes two incisions with his machete at right angles, coming together in the centre. This is done to ascertain where the milk runs best. Once decided, the tapper makes a narrow incision at the point of convergence and improvises a funnel of the same leaf used in lining the hole in the ground. This acts as a conduit for the milk, which runs from the tree in a steady stream into the hole until it coagulates along the line of incision, when, if desired, it is scraped off twice or more before the stream finally ceases. Very often the milk spurts out, and one could not stand close to the tree where the machete is at work without getting one's clothes spoiled. The rubber coagulates where it falls on the clothes, and will not wash out; only a solvent will remove it.

The bark of the tree is not only cut once, but at least four or five times, at intervals of two feet. The next year the angles cross each other, giving the tree a peculiar criss-cross appearance. Once the milk is flowing freely, the tapper leaves the tree and goes to another, repeating the process already described. By the above method a dozen trees are considered an average day's work. When the milk ceases to flow the tapper returns and carefully picks up the leaf in the hole and pours its contents into a large gourd. This is naturally a crude and wasteful process. An unskilled tapper either gets all the milk on his own clothes or else it runs round the tree and is lost. It is usual to begin tapping in May and continue until December inclusive.

THE LATEX.

The latex, or milky juice of the bark of the rubber tree, is quite distinct from the sap which circulates through the wood, and contains from 32 to 44 per cent. of gum. Pure rubber milk is white when it first runs from the tree, closely resembles that of the cow; but in the drying process it gradually oxidizes and turns black.

COAGULATING—NATIVE INDIAN METHOD.

When the milk is brought in from the forest it is thinly spread on the long, palm-shaped leaves of the *oja blanca*, which have first been laid on the ground in the hot sun. Toward the stem, where the milk lies thickest, it is necessary to stir it while drying; otherwise it would coat over thickly on the outside and be full of the residue fluid, bringing a lower price in consequence. When the leaves are coated evenly, a quarter of an inch thick, they are piled one above another and pressed hard enough to cause the rubber strips to adhere closely. Then by a dexterous movement, the tough leaves are pulled off and the thin layers are rolled into slabs ready for packing.

CLEANSING THE RUBBER.

The slabs of dried rubber are packed in bales of 150 pounds each, covered with the native-made matting, sewed up in sacks, shipped per steamer to various countries and sold to the rubber manufacturers. The first process in the manufacture of crude rubber—necessary on account of its being prepared by the native method—is to pass the slabs through large corrugated steel rollers, water falling from a reservoir upon the rubber as it passes through. This is repeated a number of times until all the dirt and foreign matter is eliminated, and the rubber rolled into thin perforated sheets having a rough surface. These sheets are from eight to twelve feet long, and eighteen inches wide. They are then hung in the dry room, where they remain until all the moisture has evaporated. The rubber is then ready for the next process.

WASHING THE RUBBER.

By the methods now adopted the foreign matters are washed out of the latex before coagulation takes place, thus producing a very high grade of rubber from the *Castilloa*, having a marketable value equal to that of Para.

Until now it was generally assumed that the Central American rubber was of much inferior grade to that of Para. It has now been proved, however, that the actual difference is very slight, if there is any, and resolves itself into the question of preparing it for the market at the time of tapping. During the past few months the best qualities of some rubber from cultivated *Castilloa* trees brought \$1.54 and \$1.56 gold per pound on the London market. This price was higher than that of best South American Para sold at the same time. Mexican rubber from wild *Castilloa* trees and shipped in the old way already referred to was quoted at 60 and 65 cents per pound, or less than one-half the price obtained for the same rubber prepared according to modern methods. As it is necessary to treat the latex as soon as possible after it is collected from the tree, receiving stations should be established on a large plantation, such as La Zacualpa, so as to avoid the transportation of the latex to any great distance.

BLACK-LEG.*

By W. H. DALRYMPLE, R.C.V.S.

From time to time the Veterinary Department receives requests for information regarding "Black-leg," a disease quite fatal to young cattle frequently in the best of condition, but which does not appear to be recognized by many, and it is for the purpose of supplying to our cattle owners something like accurate data on the subject that the Station publishes this short bulletin at the present time. We are not prepared to say that this disease is of more frequent occurrence than heretofore in the State: but, on account of the greater tendency on the part of our people to raise and own animals of better breeding, and, in consequence, of greater value, losses occurring in their stock may be receiving more attention as to cause, with the result that the trouble is being more frequently recognized rather than becoming more frequent.

The value of young "scrub" cattle is relatively so inconsiderable that when a few of them die on the farm little thought is taken of the probable cause of death and, therefore, no investigation is made to endeavour to discover it. Black-leg may have been at the bottom of many of such fatalities in the past, unrecognized, and because of the proper sanitary measures not having been taken to destroy infection in the bodies of the victims, the disease may, no doubt, have become established in certain localities, laying the foundation for the cases in the more valuable animals, and which, because of their greater value, has caused owners to seek more information regarding the fatal ailment. Fortunately, although the disease is a very fatal one among young cattle, it can be almost wholly prevented by vaccination. In fact, statistics recorded by the National Department of Agriculture at Washington go to show that out of 1,500,000 animals vaccinated, the loss reached only about one-half of one per cent.

Besides being known as black-leg, the disease has other names, such as black-quarter, quarter-ill, symptomatic anthrax, symptomatic charbon, etc. To avoid confusion, however, we will confine ourselves to the first name, black-leg. The use of the terms, symptomatic anthrax and symptomatic charbon has led to a good deal of misunderstanding and error in our State, so far as this disease is concerned, because, having anthrax or charbon as a part of the name, many have been led to think that the disease was genuine anthrax or charbon. Some writers on veterinary medicine use the terms, symptomatic anthrax and charbon symptomatique (the French), because of its apparent resemblance to the external appearance of that disease, especially a swelling that is usually to be found in those parts of the body thickly clothed with muscular tissue. But since bacteriology has assumed the rank of a most important science, it has been found that the two diseases are separate and distinct and produced by entirely

*Bulletin No. 85, March, 1906, of the Agri., Experiment Station of Louisiana.

different organisms or germs. So that, in reality, the one has nothing at all to do with the other; the only similarity of importance being perhaps that both are rapid and fatal in their effect. For the information of our German settlers we may mention that this disease is known in their language as "Rauschbrand."

CAUSE.

Black-leg is a rapidly fatal infectious disease of young cattle and is caused by a spore-bearing organism, the *Bacillus Chauvoei*. Spring and fall are said to be the most favourable seasons for the development of the ailment, and cattle between the ages of six and eighteen months are the most liable to become affected, although partial susceptibility seems to remain up to about four years.

The manner of infection is by indirect contact with the germ on infected soil, the organism gaining entrance to the body through abrasions of the skin, and, perhaps, in rare cases, through the mucuous membrane of the mouth and other parts of the alimentary canal. The wounds or abrasions are generally quite minute in size, but sufficiently deep to penetrate through the skin into the tissues underneath. Punctured wounds, such as those received from barbed wire fences or from stubbles or briars in pastures, seem to be the most likely method of infection, and correspond somewhat closely to the only manner in which the disease may be produced artificially—viz., through injection of the virus hypodermatically.

SYMPTOMS.

The disease is easy of recognition on account of the symptoms being quite characteristic. It is characterized, first, by the symptoms of a more or less intense fever, and by the appearance of a specific tumour, or swelling, upon the body, neck or upper part of the limb above the knee and hock, causing stiffness or lameness. This swelling is almost constantly found in the thick flesh or muscles of the parts mentioned. It consists of a progressive inflammatory enlargement, of firm and uniform consistence, rapidly extending in area and depth, and later becoming insensitive, crepitant and resonant, or in other words the swelling emits a crackling sound when the hand is passed over it. This crepitant sound is due to the collection of gas in the affected flesh, and which is produced by the germs of the disease. When the swelling is cut into, a frothy, dark red fluid escapes, and the flesh of the swelling is dark in colour, with the appearance of being mortified.

With few exceptions, the disease terminates fatally, death usually occurring in from twelve to thirty-six hours after the first appearance of the symptoms.

TREATMENT.

With regard to treatment, it may be said that curative (?) agents are of little or no avail—prevention being the only satisfactory method of attacking the disease. This may be divided into the following, viz., hygienic and preventive or protective.

Hygienic.

This aims at destroying or preventing the spread of infection in all places where cattle are kept, and the second, to endeavour to fortify the systems of susceptible animals against an invasion of the black-leg germs.

Similar to anthrax (charbon) in this respect, black-leg infection is largely spread from the dead animal through the medium of carnivorous animals and birds (dogs, buzzards, etc.), or omnivorous animals (hogs) attacking the carcasses and carrying the germs broadcast, or the victim may be skinned for its hide, or incisions made into the swellings to "doctor" the patient, and the infection scattered from the cuts made in the swelling. These and other processes naturally assist in disseminating the virus or poison. In a circular on this disease, issued by the United States Department of Agriculture, at Washington, D. C., the following paragraph is italicized in order to give it emphasis: "It is, therefore, of the utmost importance that cattle owners in the infected districts be made to realize that an animal affected with black-leg may be the cause of large subsequent losses from the same disease, perhaps not immediately, but within a period of years to follow, and it can not be recommended too urgently that they make every effort to reduce the danger by taking adequate measures to destroy, as completely as possible, this source of renewed infection."

The best method of disposal is to cremate or burn the dead animal, and in order to ensure complete destruction of it, it should be placed on a couple of logs, or over a trench, and plenty of dry wood heaped around it. A few quarts of coal oil should then be poured on, and fire set to it. It has been claimed that in some parts of the State it is not possible to obtain sufficient wood for the purpose of burning up the bodies of animals that have died from infectious diseases, such, for example, as in certain parts of southwest Louisiana. This section, however, has the advantage of having oil in abundance, and an inexpensive and convenient method is, first, to dig a trench of sufficient size, and placing in the bottom of it a quantity of old sacking to act the part of a "wick," then saturating the sacking by directing a pipe from a barrel filled with oil into the trench. By regulating the flow of oil, a continuous flame may be kept up until the carcass is completely consumed, and at a minimum of cost where such a method can be conveniently undertaken.

It is important that the carcass be entirely destroyed. The place, also, where the body has lain should be subjected either to heat or it should be sprinkled with some powerful disinfectant, such as crude carbolic acid, creolin, zenoleum, lime, or other agent.

Unfortunately, there has as yet been no sure method found of completely eradicating black-leg infection from a pasture.

Preventive or Prophylactic.

It is to the division of prevention which we term prophylaxis, combined, necessarily, with the hygienic, that we have to look for the most gratifying results, which are to be found in preventive

vaccination of susceptible animals, and for which we are indebted to the discovery of Arloing, Cornevin and Thomas, that animals could be protected against black-leg by injecting them with more or less virulent material obtained from the tumours of animals that had died of the disease. The beneficial results of this treatment may be appreciated by the reference made in our preliminary remarks concerning the record of the United States Department of Agriculture. And, further, it may be mentioned that during the fiscal year ending June 30, 1904, the Department distributed over 1,000,000 doses of black-leg vaccine, which were used and reported upon by over 10,000 persons with highly satisfactory results, the mortality reaching only 0.44 per cent.

Black leg vaccine is now a commercial commodity and may be obtained from, or through, any of our large wholesale druggists, directions accompanying the material, or it may also be had, free of cost, by making application to Dr. A. D. Melvin, Chief of Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C., and subscribing to certain stipulated conditions.

In conclusion, it may be stated that, although sheep and goats, as well as cattle, are susceptible to black-leg, they are rarely attacked by it, the disease being most common and destructive in the young bovine species.

NEW METHOD OF KEEPING FRUIT BY THE USE OF FORMALIN.*

A good method of conserving fruit in as nearly as possible its natural state has been largely sought after for a long time, but whatever means have been employed, a perfect result has not been obtained. One reason is the rapidity with which fleshy fruits ferment and rot under the action—as Pasteur has demonstrated—of various organisms, fungi and bacteria. Taking this view, and believing that if these micro-organisms could be destroyed, the period during which the fruit can be kept in perfect condition might be considerably prolonged, the English agricultural authorities have instituted a series of experiments under the direction of the Jodrell Laboratory, Kew. These have been very successful. The English Journal of the Board of Agriculture reviewed them in a recent number (No. 5, August, 1905, "Method of preventing the rapid decay of ripe fruit.") This high authority gives its fullest support to the scheme.

The method which has produced the best results is to immerse the fruit in cold water containing 3 per cent. of trade solution of formalin (40 per cent. of formaldehyde.)

There are two methods employed, according as the fruit has a soft pulp or is firm-fleshed, and whether it is eaten whole or not. With the former class, to which cherries, strawberries, grapes, &c., belong, the fruit is plunged into the solution for ten minutes.

*From the *Journal d'Agriculture Pratique*, in *Agricultural Gazette of N. S. Wales*.

Then it is taken out and steeped for five minutes longer in cold water, and is finally spread out on a metal strainer, or in any other suitable place to allow it to drain and dry. In the second case, when the fruit has a peel or skin which is not eaten, it is subjected to the formalin solution only.

The Kew experiments were carried out on five kinds of fruit—cherries, strawberries, gooseberries, pears, and grapes. These had not been specially selected, but were bought in fruit-shops, and in some cases from street vendors.

The following figures show the number of days during which the fruit so treated remained perfectly sound, after an equal quantity of each fruit, non treated, taken for comparison, had become rotten :—cherries, 7 days ; strawberries, 4 ; gooseberries, 7 ; pears, 10 ; and grapes, 4. These results apply in every case to fruits which were perfectly ripe at the time of treatment ; but if they are subjected to the process before maturity, they keep just as well, while the normal development and flavour undergoes no more alteration than when the fruit is placed in a refrigerator.

It would have been interesting to know the length of time which elapsed between the beginning and end of the experiment, in addition to the number of days during which the treated fruit remained in good condition longer than the other. The practical English people, having proved that this method of conservation is excellent for their indigenous fruits, are hoping to see their markets supplied with several delicious varieties of tropical fruits, which, under former conditions, has been impossible.

A minute examination of ripe fruit from the West Indies intended for the Colonial Produce Exhibition at the Crystal Palace, clearly showed that the decomposition of the mangoes, for instance, during the journey was entirely owing to mould and fermentation caused by bacteria and fungi attacking the outer surface, and not owing to a tendency of the fruit to decay or ripen too quickly. A similar treatment could be profitably employed on a number of tropical fruits which are imported in a good condition (such as bananas), but which often have a dark and disagreeable appearance, caused by an exterior fungus. Pears, apples, oranges, citrons, &c., might all be treated with the same advantage.

In England great importance is attached to this new means of conservation, which is at once very simple, inexpensive and absolutely harmless. Several other preservatives have been tried, but taking all conditions into consideration—ease of application, smallness of cost, and perfect safety during its application—formalin comes easily first. It is easy to understand why the English, who are the greatest importers of fruit from all parts of the world, should be eager to discover a process for preserving as long as possible its quality and appearance ; and it is because of their incontestable and official statements that we think it obligatory on us to bring this new process under the notice of all producers, merchants, and consumers, to whom the preservation of fruit is a daily problem.

But although the use of the preservative is chiefly directed towards the keeping of table fruit, it might be applied quite as advantageously to cider fruit. Many cider apples and pears, in spite of the great resistance of their anatomical structure, as compared with that of the garden varieties, have just as much need of protection. The greatest enemy to cider apples intended to be kept for a long time is rot. It originates in the same way as on eating-apples, and there can be no doubt that the same treatment will produce the same results on similar subjects. We repeat the mode of procedure. Plunge for ten minutes in cold water containing 3 per cent. of formalin. A tub or a cask cut in halves will serve for the purpose of a bath. Take out the fruit, and drain and dry on trays, then place in the storeroom as usual, putting on one side for comparison a lot of the same species and weight which have not been sterilised. The expense of this new method of conservation is quite insignificant, and the profits must be very high if the fruit will keep for some time in a perfect state as is alleged; and if the treatment can be as successfully carried out with the more delicate garden fruits, it will become of immense importance, and affect every species under the sun.

COCO-NUT BUD ROT DISEASE.

Coco-nut trees are often unproductive for various reasons, and they die from diseases due to different causes. But for some years it has been evident that a specific disease has been attacking these trees independently of unsatisfactory or unhealthy conditions.

This is known now as the "bud-rot" disease, from its habit of attacking those portions of the tree which are in the young, immature, or bud stage.

The flowers, while still in a very immature stage of budding, are most liable to attack; but instances also occur where the "cabbage" is first attacked while the tree is in full bearing and shows no sign of disease. As the "cabbage" is the vegetative bud of the whole tree on which its life depends, the disease is fatal when it reaches it.

The appearance of the flowers is well known. There are several long branches, covered with numerous small flowers, which contain pollen only, and a few larger knob-like flowers, which gradually grow and become coco-nuts.

The flowers and branches are at first all enclosed in a sheath or spathe, and in this condition the whole thing is commonly called a "sword." The earliest appearance of the "sword" is as a small protuberance just above the base of the leaf-stalk.

The disease is most liable to attack the tree when the "swords" first bud out. If it attacks these when they first appear, the probability is that they rot away without growing much, and the tree has the appearance of being sterile. Or, it may insinuate itself at a later stage, and grow up amongst the flowers possibly even without affecting the outer sheath. The effect is to cause the nuts

to drop at various stages, either when they first appear after pushing out from the sheath or even when they are nearly full-grown.

The disease extends from the flower bud along the stalk of the adjacent leaf, causing it to turn a yellow colour, and spreads along the stem itself, until finally it reaches the "cabbage" and kills the tree.

Although bacteria have been found in great numbers in diseased spots, it is not yet decided whether they constitute the disease itself, or whether they are only the accompaniment of another disease.

But the practical point is that by means of experiments which have now been carried on for some time, it has been shown that this disease can be checked by two methods. One plan is to fire the tree by putting a light to the fibrous material, the so-called "strainer," at the base of the leaves during dry weather. The fire burns the leaves, and scorches all the tender parts, killing the disease.

Another plan is to spray the head thoroughly with Bordeaux mixture. Several instances can be pointed out where trees have been sprayed, and are now healthy-looking and are holding their nuts. It is advisable, however, to spray diseased trees every six months, for say two years, as a prevention against its breaking out again.

Firing a tree is the easier method, and there is no expense for spray pump and for the Bordeaux mixture: but the leaves have been burnt, and it will take about two years before any fruit is obtained. If the average annual crop is worth 4s., this delay means a loss of 8s. a tree.

The expense of the Bordeaux mixture and its application is estimated to cost about 2d. a tree, without counting the cost of the spray pump.

The spray pump can be worked by two boys, one to climb the tree, and point the nozzle at the end of the hose downwards all round the head, while the other works the pump.

When the cabbage is rotten, or when a tree dies, it should be cut down, and the head with its leaves should be thoroughly burnt, otherwise it remains a source of infection to other trees, not only in the neighbourhood, but probably for long distances round.

BORDEAUX MIXTURE.

Bordeaux mixture is best made according to the following formula :—

Blue Stone (Copper Sulphate)	6 pounds
Unslacked Lime	4 pounds
Water	50 gallons .

It requires careful mixing, or the ingredients will not combine properly. Put 25 gallons of water into a barrel. Tie up 6 pounds of copper sulphate in a piece of coarse sack, and hang this by a stick laid across the top of the barrel so as to be just beneath the surface of the water until it has slowly dissolved.

In another barrel slake 4 pounds of lime very slowly and carefully, at first only adding about a quart of water at a time, until a perfectly smooth paste, free from grit is obtained. Add water to make the whole 25 gallons, and wait until cool. Now pour both together into a cask holding 50 gallons. The milk of lime should be thoroughly stirred before pouring, and finally the mixture should be well stirred for four or five minutes with a wooden paddle.

If not perfect, the mixture is liable to injure the foliage, and in order to test this, put the blade of a penknife into the mixture and leave it for one or two minutes. If there is any deposit of copper on the blade, showing a brownish colour, it is not safe to use it, and more lime must be added until the knife is not discoloured.

HOW TO KEEP MOSQUITOES FROM THE HOUSE.

The following rules for preventing the mosquito plague is adapted from the United States *Bulletin*:—

1. Mosquitoes breed *only* in water; usually standing water in artificial places, not running streams.

2. Mosquitoes occur in the vicinity in which they breed. Invasions from long distances are exceptional.

3. The young mosquito or "wiggler" lives in water at least 10 or 12 days.

4. Although the wigglers live in water, they *must* come frequently to the surface to breathe.

5. Kerosene oil on the surface of the water prevents the wiggler from breathing.

6. Destroy the breeding places and you will destroy the mosquitoes.

7. Empty the water from all tubs, buckets, cans, flower pots, vases, etc., once a week.

8. Fill in or drain all pools, ditches and various excavations, such as post holes left unfilled, etc.

9. Change regularly all water needed in chicken-runs, yards, etc.

10. Treat with kerosene oil all standing water which cannot be screened or drained (1 oz of oil (two tablespoonsful) will cover 15 square feet of surface). The oil does not affect the water for use if the water is drawn from below.

11. Put wire netting over cisterns, wells and tanks of water in every-day use.

12. Places in which it is undesirable to place oil, such as watering troughs for stock, ponds, etc., can be kept free of the wigglers by putting in gold fish. The nymphs of dragon flies and tadpoles of frogs also feed on the wigglers.

13. See that the plumbing about the place is in perfect order. Prevent leakage of pipes or clogging of eaves and gutters.

14. Inspect all cesspools and see that the covers are *absolutely* tight.

15. Clean away all weeds, grass and bushes about ditches, ponds, and other possible breeding places, since these afford a hiding place for the adult mosquitoes.

16. Clean up vacant lots and back yards of all cans, tins, bottles and rubbish.

17. First do away with or treat all places where mosquitoes are known to breed, and then begin to work on places where they might breed. Remember that large quantities breed in wild pines, hollows in trees and in banana leaves. Keep the vegetation low near the house.

18. As a citizen of your community you should feel a personal responsibility for the destruction of the mosquitoes in your district, and seek to co-operate with your neighbours in the work of doing away with breeding places. Inspect and treat with kerosene-oil, gutters, culverts, ditches, man-holes, catch-basins, etc., along the roadside. Man-hole covers should be screened.

19. Where oil is applied to standing water it must be distributed evenly over the surface. Use a hand syringe, or, if the area is great, a knapsack sprayer.

20. Houses should be cleared of all winged mosquitoes by the burning of insect powder. The mosquitoes will fall to the floor, and should be collected and burned.

21. Relief in any community or district depends entirely upon the co-operation of the members of the community.

EXPORTING SEED OF PARA RUBBER.

By H. N. RIDLEY, M.A., F.L.S., Director of the Botanic Gardens, Straits Settlements. *

As is well-known, the seed of the Para Rubber tree deteriorates very rapidly after it is ripe and soon loses its germinating power, it is not always easy to send seed long distances without a very large percentage of losses, at the same time the demand for seed in distant parts of the world is very considerable, and a good many experiments have been tried in the Botanic Gardens in various methods of packing to ensure their arrival in good condition. The reports received from the recipients of these seeds have been remarkably good, as the following records will show:— Of 7,500 seeds sent to Jamaica on August, 31st, were received on 25th October, and Mr. Fawcett writes:— “The 7,500 seeds sent in biscuit-tins are all germinating very well and we shall scarcely lose 500 of them.” †

One hundred were sent in a similar manner to Calabar on the date July, 6th and arrived on September, 20th. The Acting Secretary writes in reply:— “The seeds were soaked in water for

* Agricultural Bulletin of the Straits and Federated Malay States. Vol. V., No. 1., Jan., 1906.

† Over 87 per cent. of the seeds sown germinated, but some of the seedlings were constitutionally weak and died, so that only 5,071 plants survived, or about 68 per cent. of the seeds sown. A Wardian case arrived with 2,500 seeds, but only 18 plants were raised out of the whole number. *Director, Bulletin of the Agricultural Department, Jamaica.*

two days on their arrival and were then planted with the upper portion left above the soil. Ninety out of the hundred seeds have already germinated (Nov. 7th.) and appear healthy young plants.

To the Royal Gardens, Kew, 135 seeds were sent on July, 6th, packed in charcoal, in a biscuit-tin. They arrived in a month, and 123 germinated. On February, 12th, 1903, 20 seeds were sent to Mr. J. C. Harvey, Vera Cruz, Mexico, who writes, May 19th, 1903, that "out of the 20 seeds of *Hevea brasiliensis* I have 14 young plants. They came up in a few days, and possibly a few more may germinate, though three seeds were decayed." These were all sent in biscuit tins. Those sent to Jamaica were packed in slightly damped incinerator earth, but it was necessary to replace the upper part of the packing with sawdust to reduce the weight, as incinerator earth is very heavy and the box, a two-pound tin, which contained 150 seeds would have been over parcel post weight.

The other tins were filled with damp charcoal finely powdered. In packing, a certain amount of care is required in damping the charcoal so as to get it equally moistened all through, and not either over wet or over dry. This is best done by damping the charcoal thoroughly and then drying it in the sun constantly stirring and turning it over, till it is uniformly slightly damped. The incinerator earth which had been exposed to the elements was damp when received and only wanted partial drying to fit it for packing. Its weight is against its use, but both it and the powdered charcoal have the great advantage of preventing any attacks of mould or bacteria likely to cause decomposition. Other experiments with powdered coir fibre, and coir dust, sawdust and variously prepared soils have been tried, but the results do not seem to have ever been as successful. One experiment was made in putting the seeds in water for a month, and though that might be effective for a fortnight or so, they had all perished by the end of the month.

ACREAGE IN RUBBER.

Sir Frank Swettenham writes with regard to an article which appeared in *The Standard* of August 8 last :—The acreage planted with Para rubber in the Straits and Malay States on January 1 last was 30,000 acres, and in Ceylon 25,000 acres. Since that date the total area planted in the Malay States does not amount to 10,000 acres.

The United Planters' Association in the Malay States have taken pains to go into this question, and in their latest report they give the following figures : Total acreage planted with rubber in the Straits and Malay States 30,000 acres; Sumatra, 5,000 acres ; Java, 5,000 acres ; Ceylon, 25,000 acres ; India and Burma, 5,000 acres ; total 70,000 acres. Allowing that all this is good, and will give the

good yield of 200 lb. per acre, the amount produced would be 14,000,000 lb. This acreage cannot, however, be all in full bearing till the end of 1911, and they calculate that no more than this acreage can be in bearing till 1911, because it is not yet planted.

The exports from Para for the last three years have remained practically constant at about 30,000 tons, and the world's production was, in 1898, as nearly as it can be ascertained, about 60,000 tons, or 134,000,000 lb. The present production is estimated at 70,000 tons, or 156,000,000 lb., of which Asia can only produce 14,000,000 up to the year 1911. What she can produce after that date will depend upon the area planted and successfully cultivated between now and 1911.—*Standard*, Dec. 6.

PLANTING OF HARD AND SOFT WOODED PLANTS.

By W. J. THOMPSON, F.R.H.S., Travelling Instructor.

In travelling about the country I am surprised to find how few people seem to remember that hard and soft wooded plants need totally different treatment to enable them to develop properly. People go on planting young cocoa and orange plants just as they plant banana suckers, with the result that most hard wooded trees are not giving more than half the crop they should.

Two typical types of soft wooded plants are banana and cane; two typical types of hard wooded plants are cocoa and oranges.

The soft wooded plants, which consist chiefly of water, need to have their bases covered with a considerable amount of damp soil if they are to continue thriving. On the other hand, hard wooded plants, consisting chiefly of wood, need just the reverse condition to get them to grow as they should, viz., the base of the plant must be kept level with the surrounding ground, so that it can get enough sun, light and air.

It is most important that planters of all degrees should realize the different requirements of the two different classes of plants. In almost all cases where I am asked to inspect sickly plants and trees of cocoa, &c., I find that most of the cases where the young plants are not growing, or old plants are not fruiting, or dying off, can be traced to the plants having been planted too deeply. I have come across scores of cases where cocoa plants have had their bases from 3 ins. to 12 ins. below the surface of the ground; and although when the bases of this class of plants are planted too deeply, nature comes to the tree's assistance by young roots being formed just below the surface of the ground, these surface roots do not compensate for the loss of the natural upper roots of the tree which have died off, or are in a half dead condition through not getting enough light and air. With deep planting, if the plant does not die after a few years, it does not give the amount of fruit that a properly planted tree will do. Too much time and care cannot be given to the planting of these hard wooded plants to see that they are planted properly.

In July last, in St. Catherine, I inspected about 20 cocoa trees—old trees, about 12 feet high; only three of the trees had their bases showing level with the surrounding ground; and although this is the season when we do not expect to see many cocoa pods on the trees, one tree had 60 pods, the other two had from 40 to 50 pods each, while the rest of the 17 trees had not 60 pods between them.

Within the last few months I have been paying a good deal of attention to the question of shade for cocoa, but I have found that in all cases, if the cocoa tree has been properly planted that the trees gave good returns whether they were shaded or not; but where the tree had been planted too deeply, whether shaded or not, the condition of the tree and the yield were not satisfactory.

In planting out hard wooded plants, intelligent workmen should be employed, and it should be strongly impressed upon the workmen which the base of the plant is and that when the soil has finally settled down, the base of the plant should be level with the surrounding ground.

I observe that when the workmen are going to plant out seed or young plants of cocoa after the soil has been cultivated, that they are careful to make a kind of shallow basin, and when it comes to planting the seeds or plants are placed from two to six inches deep. This way of planting is wrong, and is responsible for such a large percentage of plants not giving satisfactory results.

The way to prevent the plant from settling down too low after planting is to leave the cultivated soil six inches higher than the surrounding ground where the plant or seeds are to be planted.

As a rule if seeds are being planted, there is not so much risk in putting them too deeply; but even with seeds, after the soil has been made somewhat fine, care should be taken to see that they are not planted more than an inch under the ground. I find that it is when seedlings are planted out, that the greatest loss takes place.

When transplanting the young cocoa plant from the bamboo pots or beds, care should be taken to take off a little of the surface soil till the base of the young plant is reached, and after this is found, make a small hole in the raised soil and put the young plant in the soil; just deep enough for the base of the plant to be on a level with the raised soil. It is better to place the young plant an inch too high than half an inch too low.

This may seem a small matter to some people, but I have looked into the subject minutely, and to say that one-fourth of the young plants planted out each year die, and that from the fruiting trees we are not getting as much cocoa as we should by 40 per cent. through the trees being planted too deeply, is making a very low estimate of losses.

This deep planting of such plants as cocoa and oranges is a most serious matter for the planter.

If all small, stunted cocoa trees, such as make a little growth in the dry weather and die back in a wet season are examined, it will

be found, if the soil is taken away from the stem, that the base of the plant is several inches below the surface of the ground. In such cases I would strongly recommend that the plants be dug out and thrown away; they cannot be transplanted and would never do any good if left to grow. The same advice applies to citrus plants.

Unless care is taken to get these young plants properly planted, good soil, manure, labour, etc. are all wasted, and those who will look into the matter will find that all the cocoa trees that are giving good returns, have their bases level with the surface, and those that are not giving good returns or are in a half dead state will be found with their bases several inches below the surface of the ground.

The reason why these hard-wooded trees do not thrive when planted too deeply in the soil, is because the base of the tree is kept too damp and cold, the lower roots of the tree die off and the few surface roots cannot support the tree. That Jamaica has the climate and soil conditions suited for producing very fine cocoa can be judged from the fact that we have cocoa trees in the Island measuring 60 inches round the trunk two feet from the ground, the trees being in a healthy condition and giving large crops of pods each season. These trees are exposed to all the sun that passes, and the bases stand level with the surrounding ground.

TURMERIC.

Turmeric* is extensively cultivated all over India for its root-stocks, and is now found more or less wild in Jamaica, especially in the western districts. It is the well-known *haldi* universally used as a condiment with curry-stuffs and also as a dye, and is one of the most profitable of crops in India. The dye-yielding rhizome is harder and much richer in colour than the edible.

CULTIVATION.

The preparation of the soil necessary for turmeric is similar to that for ginger, but lands intended for turmeric need not be worked so fine. The usual planting time in India is about the 20th of May. The plants spring up in about a fortnight. One or two weedings are necessary, and care must be taken that the fields are not inundated. After about a year and nine months turmeric is lifted. When it is raised the first year, as is the practice in some places, the produce is less in quantity and inferior in quality.

PREPARATION OF THE ROOT-STOCK.

Various systems are apparently practised for preparing the rhizome for the market. Of Bengal it has been said: "After the rhizomes have been dug out of the ground, they are freed from the fibrous roots and cleaned. They are then put in earthen pots, the mouths of which are to be carefully closed with earthen covers

* *Curcuma longa*, Linn. Information from Dictionary of Economic Products of India; and Bentley and Trimen's Medicinal Plants.

and cow-dung. These pots are then very carefully heated. The turmeric is made to boil in its own juice, a process which gets rid of the raw smell of turmeric. It is then dried in the sun, the drying taking nearly a week, during which the turmeric requires to be covered in the night to protect it from dew. In some places turmeric is boiled in water in which a little cow-dung is mixed."

Of the north-west provinces, Sir E. C. Buck says:—"When dug up the roots are boiled and dried in the sun; in this form they are the turmeric sold in the Indian bazaars. When the dye is to be used the roots are again boiled and powdered while wet. A decoction is then made of this paste in water, in which the cloth is well steeped, being subsequently dried in the shade. In the Kumaon district the roots are soaked in lime-juice and borax before being powdered instead of being boiled." Of the Punjab, Mr. Baden Powell says the tubers are taken up in November and dried partly by the action of fire and partly by exposure to the sun. Of Coimbatore it is reported:—"The roots are carefully sized and separately boiled in a mixture of cow-dung and water, dried and sent to market."

CHARACTER AND VALUE IN COMMERCE.

There are two sorts of turmeric seen in commerce—the *round* and the *long*, but both are the produce of the same plant; the central rhizomes or root-stocks constituting the round, and the lateral or secondary rhizomes (*tubers*) the long; the latter are the more abundant. The *former* are roundish or somewhat ovate, usually from about one inch and a half to two inches in length, and one inch in diameter, pointed at one end, and marked externally with annular ridges. They are often found cut into halves. The *latter* are somewhat cylindrical, more or less curved, pointed at the two extremities, frequently having on their sides one or more short knobs or shoots, about the thickness of the little finger, two or three inches long, and marked externally with annular ridges. Both sorts are yellowish externally, very hard and firm, and when broken having a waxy-resinous appearance, and an orange-yellow or reddish-brown colour. The powder is orange yellow. Turmeric has an aromatic taste and odour somewhat resembling ginger, but peculiar. When chewed it tinges the saliva yellow.

The following is a quotation from the Market Report published in the *Chemist and Druggist* for 23rd September last:—

"Good Madras finger has been sold at from 17s. to 17s. 6d. per cwt., being steady, and Cochin split bulbs are quoted at from 7s. 9d. to 8s. per cwt., according to quantity."

DYE.

A special form of turmeric is grown for this purpose, namely, a harder root, much richer in the dye principle than in the ordinary condiment form.

The colour is only deposited in the rhizome with age, and hence, in all probability, the above mentioned forms have been obtained by a process of careful selection of stock

observed to produce the colour freely. It is of importance, however, that the European merchant, in purchasing for dye purposes, should see that he gets the hard dye-yielding form and not the softer aromatic condition, which is used as a condiment.

The rhizome is still largely used by the European dyers, though the fluctuation in the trade may be viewed as due to the development of the aniline industry. Professor Hummel says of it :— "Notwithstanding the very fugitive character of the colour it yields, it is still much used, especially by the wool and silk dyers for the production of compound shades—olives, browns, &c. It gives a bright yellow colour without the aid of a mordant, but when mordants are used with it, it yields other colours not unlike those obtainable from the yellow dye-woods. The colouring matter of turmeric is one of the few for which cotton has naturally a strong attraction."

Although turmeric is rich in colouring matter, its want of permanence is a hindrance to its application as a dye-material.

Some time back the use of turmeric was almost exclusively limited to printing and dying silks. It is now employed to a vast extent in stuff-dying, forming an important constituent in certain compound colours, especially the so-called "sour-browns."

FOOD.

Turmeric forms one of the indispensable ingredients in curries, and is used for colouring confections, etc.

MEDICINE.

Turmeric contains about one per cent. of a *volatile oil*, to which its odour is due, some *starch*, a yellow colouring matter called *curcumin*, and other unimportant substances. The alkalies change the colour of curcumin to reddish brown; and boracic acid produces an orange tint; hence paper tinged with tincture of turmeric is largely employed as a test of the presence of alkalies.

Turmeric is not now used as a remedial agent, but is introduced into the pharmacopœias as a test of the presence of alkalies. For this purpose the British Pharmacopœia directs unsized white paper to be steeped in tincture of turmeric and dried by exposure to the air. It is also occasionally employed in pharmacy in colouring ointments and other preparations.

Used as a stimulant in native medicine in India: externally applied in pains and bruises, and internally administered in disorders of the blood. Its use as an external applicant in bruises, &c., is perhaps its most frequent medicinal application. The fresh juice is said to be an anthelmintic. A decoction of the rhizome is applied to relieve catarrh and purulent ophthalmia.

JAMAICAN GINGER.*

According to Gillespie Bros. & Co's. New York Market Report for March 16, ginger continues to be the principal factor in the spice market. The continued upward movement of the European market, and the situation in Jamaica as reported by cable, make it almost impossible to attempt to predict what price Jamaica root will reach, or even to name quotations, London has advanced 2s. per cwt. within the past fortnight, and buyers here have advanced their offers 1ct. per lb., but were unable to obtain any ginger even at the advance. With the situation as it is to-day, it is possible to obtain almost any price within reason for the small parcels that are coming to hand. On to-day's market we quote from 8c. to 8½c. per lb. for dark scraggy root, and from 10c. to 11½c. per lb. for the small white to bright bold ginger.

STUDY OF CASTILLOA RUBBER.†

On La Zacualpa plantation in Chiapas, Southern Mexico, there has been established a botanical station, the principal object of which is to study the Central American rubber tree (*Castilloa elastica*), its culture, and the preparation of commercial rubber from this tree. On La Zacualpa and affiliated plantations there are now planted over three million trees, and at least two additional million trees will be planted. In connection with the botanical station, there is a laboratory for chemical and physiological investigation of the latex. A complete meteorological observatory will soon be ready on La Zacualpa, and two meteorological substations, will be established in the mountains close by, where simultaneous observations will be made at the elevations of 2,000 and 3,500 feet. The main station is situated at 250 feet above the sea, twelve miles from the Pacific Ocean, on the lowlands at the foot of Sierra Madre, about sixty miles from the border of Guatemala. The director of the station is Dr. Pehr Olsson-Seffer from Stanford University.

BOARD OF AGRICULTURE.

EXTRACTS FROM MINUTES.

The usual Monthly Meeting of the Board of Agriculture was held at Headquarter House on Wednesday, 13th June. Present :—The Director of Public Gardens, the Island Chemist, His Grace the Archbishop, the Superintending Inspector of Schools, Messrs. C. A. T. Fursdon, C. E. DeMercado, J. W. Middleton, and the Secretary.

Acting Chairman—The Secretary read letter from the Colonial Secretary's Office intimating that the Governor had appointed Mr.

* Extract from the *Agricultural News*, April 14th, 1906.

† From *Science*, March 16. 1:06. p. 439.

T. L. Roxburgh, Acting Colonial Secretary, to act as a Member of the Board, and as Chairman in the room of Mr. Bourne, Colonial Secretary, who had been granted leave of absence from the 9th inst. Mr Roxburgh then took the chair.

The Secretary read the minutes of the previous meeting which were confirmed.

Commercial Agent in London—The Archbishop said as a matter arising out of the minutes he would like to ask the opinion of the Board whether they should drop the matter of a Commercial Agent in London owing to the adverse reply of the Governor, or whether they should go on with it, and if so what should be done. He quoted from a lecture delivered at the Colonial Institute, what South African Colonies were doing to find new markets for their products. He believed that what His Excellency had quoted as Mr. Chamberlain's decision against Crown Colonies having Agents did not refer to Commercial Agents, but referred first to a political agent and second to a man doing business on his own account, but what we wanted was purely a Commercial Agent whose attention would be wholly devoted to the commercial interests of the Colony. There was need in this Colony for Government support, not only for the stimulus it would give the matter but for the status it would give the Colony.

Mr. Middleton supported the idea of going on with the matter.

Mr. DeMercado said he supported the idea, but in this matter almost everything would depend on the personality of the agent.

The Board unanimously agreed that the Committee already appointed to deal with the matter should take it up again, viz: the Archbishop, Mr. Middleton and Mr. Murray.

Elder Dempster & Co. £500 & Instructors—The Secretary read letter from the Colonial Secretary's Office transmitting copy of a despatch from the Secretary of State for the Colonies stating that this Government would receive £500 a year to be paid by Messrs. Elder, Dempster & Co. in lieu of their Instructors, provided the money was devoted by the Government to the same purpose.

The Secretary submitted letter from the Colonial Secretary's Office stating that the Governor had perused with interest the report on the successful working of the High Ether Instalation at Hampden Estate.

Labourers on Estates—The Secretary read letter from the Secretary of the Northside Sugar Planters' Association in reply to his letter, stating that with reference to the sale of beef, pork and bread by overseers on sugar estates the practice did not prevail on the northside estates as it was the general rule on them that particular care be taken to pay the labourers in full, and no compulsion was put on them to buy anything, and that it appeared the present law was sufficient to meet such cases.

The Secretary stated that he had no reply from the Secretary of the Westmoreland Sugar Planters' Association.

Mr. Cradwick & St. Mary Show—A letter from the St. Mary Show Committee was submitted stating that as rains prevented Mr. Cradwick from carrying out his programme for week ending June 9th

they would ask the further concession of allowing him to be in the parish for week ending 23rd June, besides week ending 30th as at present arranged.

The Board agreed that if this could be carried out, without disarranging Mr. Cradwick's itinerary materially, it might be done.

The following reports from the Director of Public Gardens were submitted :—

1. Hope Experiment Station.
2. Instructors.

The following report from the Chemist was submitted :—

Candidates selected by the Advisory Committee to attend Distillers' Course.

These were approved with the addition of Mr. F. L. Clark, Richmond Estate, who was one of the first applicants but whose name had been omitted in error from the list, the extra £10 grant to be met from savings in the Sugar Experiment Station vote.

The following papers which had been circulated but had not yet been before the Board were submitted :—

Resignation of Mr. Rudolf—Letter from C. S. O. for the information of the Board *re* resignation of Mr. Rudolf.

The Secretary stated that the Report of the Board of Agriculture and of the Chemist for the year ending 31st March, 1906, had not been returned from circulation yet.

The following papers which had been circulated were now submitted for final consideration :—

1. Work of Agricultural Students for Easter Term.
2. Report Hope Experiment Station.
3. Reports by Mr. Cradwick and Mr. Briscoe.

The meeting then adjourned till Wednesday 11th July, at 2 p. m.

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Part 8.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.,

Director of Public Gardens and Plantations.

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HOPE GARDENS.

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PARA RUBBER.

REVIEW BY W. G. FREEMAN, in Botanisches Centralblatt.

WRIGHT, HERBERT, *Hevea braziliensis* or Para Rubber. Its botany, cultivation, chemistry and diseases. (A. M. and J. Ferguson, Colombo. 106 and VII. pp. With 28 plates. 1905.)

The first plants of Para Rubber were received at Heneratgoda, Ceylon, from Kew in 1875, having been raised from seed collected by Mr. Wickham in the Ciringals of the Rio Tapajos. Propagation, first by cutting and later by seed, was carried on and now there are some 40,000 acres of this plant in Ceylon whilst large quantities of seed have been distributed to many parts of the world. Although at first it was thought that *Hevea* should be planted in places but little above the sea-level it has been shown that it will grow up to 2,000 feet and even higher in some districts of the island. The laticiferous system is briefly described and the functions of the latex discussed.

At Para itself there is a rain-fall of 80 to 120 inches and a mean temperature of 75° to 81°F., and although it is pointed out that these conditions are not absolutely necessary for the cultivation of Para rubber, many parts of the tropics possess them and in these areas the industry promises to become as important as in Ceylon, the Malay Peninsula and India.

The cultivation of the plant is dealt with in detail, and illustrated by views of trees grown in various conditions, e.g., drained swampy lands, rocky hillsides, &c. With wide planting coffee and cacao can be grown with success amongst *Hevea*, whilst as "catch crops" for the first few years, Groundnuts (*Arachis hypogaea*), Cassava (*Manihot utilissima*) and lemon grass (*Andropogon*) have given good results.

A chapter is devoted to soils and manuring. Three chapters treat fully of the important question of tapping. The harm done by bad tapping by which the wood is injured is illustrated. Various patterns of tapping instruments are described and illustrations given of several; Golledge's knife, and Bowman's and Northway's

knives are spoken of as having given good results. The use of scrapers of any kind is deprecated on the ground that in practice they tend to clog the freshly opened latex tubes. There are four principal methods in vogue of tapping trees, (a) single oblique lines, (b) V-shaped incisions, (c) single oblique cuts joined by a vertical channel; known as "half-herring-bone" when all the cuts are on one side of the vertical line, and "full herring-bone" when on both sides, (d) spiral curves. The advantages and disadvantages of the various methods are discussed. Owing to the favourable results obtained, the last method has recently gained favour in Ceylon and elsewhere. The main stem is practically the only part of the tree to be tapped and the greatest yields are obtained from the lower portion, up to six feet from the ground level. Some doubt appears to exist as to the quality of the latex obtained from higher levels and contrary results are reported from different localities. It is most important in practice to take advantage of what is now generally known as the "wound response" which is usually obvious within 24 to 48 hours after the first tapping. In an experiment quoted the yield of latex obtained from the same number of incisions, over approximately the same area on one tree, increased from 61 cc. on the first tapping, to 449 cc. on the fourteenth tapping, about two and a half months later. Tapping every day either for the whole of the rainy season or during alternate months has given excellent results on a large scale on several Ceylon estates. Trees to tap should, in Ceylon, be not less than 20 inches in circumference 3 feet from the ground and at least 4 to 6 years old. Such trees may be expected to yield 1 to 3 lb. of dry rubber per tree up to their tenth year and much more in subsequent years. Exceptionally well developed trees have given as much as 12 to 25 lb. a year without shewing any ill effects or signs of exhaustion.

The general physical and chemical properties of latex are briefly touched upon and analyses quoted of that derived from the plant under discussion. The production of rubber from latex is fully discussed, and the various methods and machines employed are described, as also the purification, vulcanisation and uses of rubber.

The commercial varieties of Para rubber are enumerated, their preparation described, and comparative chemical analyses given of various kinds of plantation rubber from Ceylon and the Straits Settlements.

The recently established value of the seeds of *Hevea brasiliensis* as a source of oil is pointed out, as also the possible use of the residual cake as a feeding stuff. The methods of transporting the seeds in a living condition are discussed; the best results appear to have been obtained by packing them in powdered charcoal and sawdust in sealed tins. The use of Wardian cases is however still the most satisfactory method. A chapter is devoted to the diseases of the plant, and an appendix contains estimates supplied by planters of the cost of planting rubber in Ceylon.

LAGOS SILK RUBBER.

The following notes on the Silk Rubber of Lagos are taken from an article by M. E. De Wildman published in the *Revue des Cultures Coloniales*, and translated in the *Agricultural Bulletin of the Straits and Federated Malay States*, Vol. II, 4 April, 1903, p. 136.

The plant is specially cultivated at present in Western Africa in the Congo Free State and on the Cameroons, and is, according to the author, the best rubber plant to cultivate in these regions, and this is so for several reasons, it is easy to procure seed as the plant is wild in this part of the world and one can be sure that it will grow well as the soil and climate are naturally suitable for it. The German Colonial reports show that *Funtumias* of the same age as *Castilloas* are relatively more advanced, the *Funtumias* give seed at the end of two years and a half, while the *Castilloa* fruits only at the end of from three and a half to four years. If one compares the latex of the two, at the same age, one can see that it is much more concentrated, less watery and sticky in *Funtumia* than in *Castilloa*, and that it can give a return more quickly. *Castilloa*, according to M. Koschny can only be milked when eight years old. As to the rubber itself, that of *Funtumia* is as good or better than that of *Castilloa*. The results of comparative researches with *Funtumia* and *Castilloa* in West Africa are in favour of the former.

The seed, sown freshly gathered, sprouts after about 15 days and grows very rapidly, and the plants are readily transported. If at first the stem bifurcates forming a bush, either a shoot is developed above the bifurcation, or one branch grows more strongly than the other eventually forming the trunk. Among the advantages of *Funtumia* one may mention that the latex flows more easily and quickly than that of *Castilloa* or *Ficus* and the seeds keep good for 6 weeks and even germinate after three months. Nor is the *Funtumia* particular as to soil, it grows equally well in lateritic or basaltic soils, in soils rich in humus or stony. As to altitude, it has been noticed that it does best below 800 metres. It is reckoned that in April, 1902, there were in the Cameroons 200,000 plants, exclusive of wild ones. The plan of planting *Funtumias* in a lightly cleared forest as has been frequently done is not recommended. They do not grow so well in shade as in full sun when they are too weak to resist the drying action of sun and wind, they naturally should be protected, but when they are strong enough to resist this they develop better when fully exposed to the sun, provided that the ground is damp enough. From the experiments made in plantations in German territory the *Funtumias* should be planted 6 metres apart.

The tree is one of the best shade trees for cocoa, but as it is pyramidal in form it will be necessary to plant close which is not a disadvantage. It is also recommended to use the tree to grow vanilla on as in ten years when the vanilla is dying out the rubber trees will be ready for tapping. The latex is coagulated by boil-

ing, but this must be done gently and can only be done after the addition of water. It is advisable also to stir the mass while boiling slowly to prevent the formation of a porous mass in which portions of uncoagulated latex may be included. After coagulation the rubber must be carefully washed.

NOTES ON THE "CASTILLOA" RUBBER TREE—II.*

By "A. FORESTER," Bluefields, Nicaragua, February 1906.

What latex is to the tree is still a debatable question. I think that it is simply a protection against insects and evaporation whenever the tree is wounded. Anything striking against the outside bark, if it hits hard enough, will bruise the inner bark so that the latex flows. An examination of this place a day or two later will show a thin coat of rubber entirely covering the bruise. Tropical trees do not have the thick outer corky bark of northern trees. Anything striking them is liable to bruise the inner bark. This sheet of rubber forming would protect the bruise from too much evaporation and from insect attacks. Leaf cutter ants do not attack the leaves of *Castilloa* and cattle do not seem to be fond of them, but I believe that this is not due to the latex but due to the thick coat of epidermal hairs, a thing which few tropical trees seem to possess. It is noticeable that ants do attack *Hevea* which has not a hairy leaf.

The study of the structure of the latex shows that it has two distinct parts—watery solutions and a solid substance in minute globules. The watery solutions contain no rubber. They do contain the substance which forms the residue of the black water, though this substance is apparently changed by oxidation before becoming black water. They may also contain sugars and proteids, as these substances are evidently there, but it is more than likely that these substances are not in the original latex but come from some other bark tissue than the "milk tubes."

The solid globules are principally rubber but they are said to be surrounded by protoplasm and contain a nucleus. In that case they would be cellular in their nature. As the tube in which they are enclosed is already a cell, it would be a case of a cell within a cell, which is rather rare in botany. At the same time they are very small for cells. I have not been able to examine the structure of the single globule, as my microscope is not powerful enough, but I think that they are not cellular but are originally chromatophores in which rubber has been stored. In that case they would be formed in a similar manner to starch grains in a potato and other roots. I believe that this is the case and that the substance in solution, later forming the black water, bears the same relation to rubber that sugar does to starch; that is, they are similar forms of

*From the India Rubber World. Continued from *Bulletin* for May.

carbohydrates which can be readily changed from one to the other by the action of an enzyme, and when they are to be transported from the soluble substance and, when stored, the solid substance. This state of things seems to be the same in all latex bearing plants, as all that I have examined contain this watery solution and the solid globules, though the watery solution does not always turn black and the solid globule is not always rubber, but some times a sticky substance.

Dr. Weber asserted that the black water was due to oxidation and he believed that rubber itself was an oxidation product. Latex which is gathered and quickly corked up away from the air, forms no black water. Black water gets blacker for longer standing in the air until about five days after gathering. Fresh black water can immediately be turned to its deepest black by ammonia, but ammonia will not affect black water five days old. I believe that the action of ammonia is the same as the oxidation in the air. Contact with metals will make black water blacker. Sugar slowly takes the black colour away and latex which has not been allowed to oxidize has water which resembles that formed by sugar. I believe that sugar reduces it to its former state. I do not see any reason to think that rubber itself is an oxidation product. It is possible, but if so it can be further oxidized by the use of nitric acid.

The problem of tapping has a great deal to do with how the latex is situated in the tree. According to most writers it is carried in "milk tubes" which are in the bark and are arranged vertically. I have not found any writers who seem to know what these milk tubes are like—whether the latex runs up or down in them, or what connection these milk tubes have with other parts of the plant. When I first got here I tried a number of experiments, trying to increase the flow of latex by multiple tapping, gradual tapping, and so on, but all these failed. The reason for these failures I now attribute to the shape and position of the latex carrying tissue in the plant. This tissue, I believe, is the part known as the bast fibre. Bast fibres are long fibrous threads, tapering to a point on each end, having a thick, tough wall and in most plants dead, and containing nothing in the cell cavity.

In the *Castilloa*, the microscope shows that the bast fibres have a larger cell cavity than in most plants. It is reasonable to suppose that they are in such cases alive and contain something. I have seen no other tissues in the *Castilloa* bark which contain the latex and therefore believe that these bast fibres do. The bast fibres are arranged vertically and are probably only a few inches long. Those I have examined in temporary branches were from 1 to 3 inches, but they are probably longer in older parts of the trees. The fibres are probably connected to each other by pits but I have not been able to locate these connections. These pits would not allow solid substances to pass from one fibre to another, but would allow water and watery solutions.

The rubber being in solid globules is probably formed right in the fibre itself. The fibres are not arranged in regular joints, as

was the opinion of Carlos Berger, but are irregularly arranged, the tapering end of one fibre fitting between other fibres. When the fibres are cut across by a tapping instrument their content is ejected by bark pressure. Such a cut will take latex from the tree only for a distance of 3 or 4 inches each side of the cut. This shows that the latex does not run up and down the tree or from one fibre to another. If no more cuts are made, the latex will not be renewed in the cut fibre for some time (not entirely for about 3 months), although the surrounding fibres are full of latex. This shows that all the latex from the tree cannot be taken from one cut.

The distance apart that cuts should be made around the tree is a disputed subject, and depends not only on the length of the bast fibres and the way to get the most yield, but also on the amount of injury done to the tree. If yield were the only consideration, one foot would be a good distance and would give, I believe, the maximum yield. Eighteen inches will give close to the maximum, giving enough more latex from each cut to make up for the fewer cuts. Both of these distances, however, are objectionable, because a large number of cuts appears to detract from the healing powers of the tree, and the more cuts, the greater the chances of the tree being injured by the borer. Another point in the number of cuts is the time and labour in making the cuts. Six cuts to a tree is twice as much labour as 3 cuts, but if it does not give twice as much rubber it would be cheaper to make 3 cuts and tap a larger number of trees in a day.

The tapping is now being done with only 3 cuts per tree; one at the base, one at 5 feet from the ground, and one halfway between these. Tapping above 5 feet necessitates the use of ladders, and this would mean more labour and would hardly pay with young trees. I believe the making of 4 cuts, the top one 6 feet from the ground, would give enough more than 3 cuts to pay, if it is not too great an injury to the tree.

The first signs of healing appear between one and two weeks after the cut is made, and in two months at the latest the cut is well healed. In time the old cut will fill with new material which contains latex and can be tapped again if necessary. Another strong reason why the tool should cut to the cambium is that not only does the shallow cut miss cutting some "milk tubes" but it misses a very large proportion of the tubes. The milk tubes are formed by the cambium in layers. The ones closest to the outside bark were formed when the tree was very young and small in circumference. At that time the patches of tubes were close together. Since then the same number of tubes had to spread out and cover a circumference of, say 18 or 20 inches. The spaces between these tubes are filled by medullary rays which run from the pith outward through the wood to the outside bark. Therefore the outermost layers contain very few milk tubes, the next more, and so on, until the innermost layer has the most since it was formed when the circumference was greatest. This is borne out in facts.

A much larger yield is actually obtained by cutting into the cambium than by cutting almost into it.

Another thing to be avoided is cutting too deep. When a cut goes through the cambium into the wood the healing commences at the edges of the cut cambium, and has to spread slowly, making new cambium before it can make new bark or wood. If too much wood is exposed in this case it will often dry up before the cambium can heal over and in that case it never heals. I have seen an old machete cut with a half inch of wood exposed, with the bark thoroughly healed all round it. I was told that it had been that way without healing for two years.

As to the time to tap, there appears to be no reason why the trees should not be tapped at any time during the rainy season. I should imagine that the driest season in March and April would be a poor time, but I have not been here during that season. Rain generally makes the milk rather watery and makes it flow more freely, but I have never seen it so watery that it would not pay to tap, except in a tree which had been recently tapped. Tapping in heavy rain would not do, as it would wash the latex, which does not flow into the cups and might fill up the cups and spill the latex in them.

Temperature affects the flow of latex very noticeably. The yield of rubber is much greater in the early morning than at any other time of the day, and always decreases toward noon and increases toward night. This is not so noticeable on cool cloudy days. It would probably not be so noticeable in a shady plantation and for this reason some people have claimed that shade grown trees yield more. I believe that the reason temperature affects the flow is because a large amount of the water is evaporated and the latex is more solid and does not flow so freely.

Experiments of others have shown that young trees and younger parts of old trees contain a large percentage of resin in their rubber. I have made one observation which suggests a reason for this. In cutting a temporary branch, or leaf stem, it is noticeable that the latex comes very close to the outside bark and that there appears to be a second ring of tubes in the inner bark. Microscopic examination of these parts shows a large number of collenchyma cells close to the outside bark. These cells are similar to bast fibres, but the thick part of the walls is not uniform. Collenchyma cells are never formed by older trees except in their young parts. I think it possible that these collenchyma cells carry latex which is richer in resins than ordinary latex and which may possibly be entirely resin. Of course these collenchyma cells remain in the plant as it grows older but form a very small proportion of its tissue at that time. It is possible that rubber or resin may have some chemical relation to the cellulose of which the thick walls of both collenchyma and bast fibres are formed.

PLANTING SEED COCO-NUTS.—II.*

The following notes on the preparation of seed coco-nuts for planting, from the Report of the Philippine Bureau of Agriculture, are worth noting :—

“In preparing nuts for planting the best results have been obtained in the following manner. The nuts are selected from trees known to be good bearers, bearing not less than 150 nuts per year, these uniform in size, brown in husk, rich in copra and fully ripe. Fully 98 per cent. thus selected will germinate successfully. After cutting they should be placed immediately in the nursery provided (of course in the shade), on the ground—not hung on poles as the native is said to do. Prior to placing in seed beds, a bit of the husk should be chipped off on one side, it should then be laid, cut side up, and left to germinate. Nine months usually elapses before they are ready for planting. The nut when placed on end, as is sometimes done, sends out a spindling plumule, easily broken at the point of protuberance, and at best never gains the vigour of those germinated according to the method given. Two thousand nine hundred and thirty-one trees have been planted this year, most of them on ground that has been ploughed and pulverized and put in the same condition as for a corn crop. The result has been a marvellous growth, the trees being more than twice as large as those left to themselves.”

BRAZILLIAN COFFEE.

The “Times” correspondent Rio Janiero says :— †

EXCHANGE.

The downward course of exchange continued apace from 17½ on the 1st February last to 14½ on the 14th of this month. The recent movement was little short of hysterical. Between Good Friday and Easter Sunday, there was no reason to believe that there would be any greater demand for bills this year than usual, yet the Banco da Republica changed the bank rate fifteen times ! Every one of these changes is telegraphed up and down the coast at enormous expense, and yet the only difference between opening and closing rates was $\frac{3}{2}$ or three points—that is to say, the market opened at four points below the closing on the previous working day, and oscillated round 15d. at intervals of about 20 minutes for no other visible reason than to keep the brokers running and the cable busy. If the 15 millions for valorisation is borrowed and remitted (a contingency not more improbable because it has been repeatedly denied) the balloon will once more be filled with gas, but otherwise the ballast thrown out by the Banco da Republica can only help for a little while, and we may soon rest again

* From the *Hawaiian Forester and Agriculturist*, April, 1906.

† See Bulletin, Oct., 1905 p. 215; June, 1906, p. 127.

on the hill of 12d., dangerously near the precipice over which we fell in 1897.

THE PROPOSED COFFEE TRUST.

The coffee valorisation scheme continues stagnant, owing to the refusal of President Alves to call a special Session of Congress. Dr. Nilo was very well received at the capital of Minas, which appears to indicate that both the States of Minas and Rio are lukewarm regarding the project. In Sao Paulo, on the other hand, planters and politicians are highly indignant at the dilatory action of the Federal Government, and a seditious spirit is commencing to make itself felt. Valorisation or separation is now the motto of the extreme faction, and the government is doubtless now bitterly repentant at having been induced to play with fire. The position is extremely difficult, and it will be very interesting to see how the executive will set about reconciling the Paulistas until November, when President Penna will have to shew his hand.

Daily entries of coffee are much larger than usual for the time of year, and Rio already shows an increase of over 300,000 bags in comparison with last year. It is quite possible that we may receive nearly ten thousand bags per diem until the end of the season. An optimistic estimate of only 3,500,000 bags for next season has been widely disseminated.

CAMPBOR IN CEYLON.—II.

An article on this subject was published in this Bulletin for June, page 129. The following extract is from a speech of His Excellency Sir Henry Blake a short time ago in Ceylon.

I want to read you the results of an experiment made by Mr. Kelway Bamber from four camphor trees growing at Hakgala, which, as you know, is 5,500 feet above sea-level, Camphor is growing and growing well at Henaratgoda almost on sea-level. Therefore, we may assume, it will grow over almost any part of this Island. These four trees were of different sizes. They took the prunings of six or eight inches, and these six or eight inches gave at the rate of 47 lbs. of prunings per tree. They calculated that each tree would bear pruning four times a year, and that would give 188 lbs. of prunings per tree per annum. Planted 12 by 12, it would give 56,400 lbs. per acre per annum of fresh prunings. Now Mr. Bamber distilled from the fresh prunings 1·5 per cent. of camphor, and from that 56,400 at 1·5 there would be 864 lbs. of camphor per acre. Then take the cost of planting, etc., at R144, distilling, fuel and labour at R30, weeding per acre R6, in all R180, and you get a net result of £74 4s. per acre. That is calculating camphor at 2s. per lb., camphor being 3s. per lb. at present. Taking half the weight of prunings, take even a quarter and you get about £18 per acre; and it seems to me this additional product is worth considering."

TOBACCO DUST AS A FERTILIZER AND INSECTICIDE.

By GEORGE LOUTREL LUCAS.

The waste product of all the American tobacco factories, in the form of stems stripped from the leaves in the manufacture of tobacco products, is saved and finely ground and forms a valuable by-product in the shape of a fertilizer and insecticide.

Good unsoaked stems contains 2 to 3% of nitrogen and 6 to 10% of potash, and only a trace of phosphoric acid; the nitrogen exists in both the nitrate and organic forms.

The potash occurs principally in the soluble form, and is free from chlorides judging from analysis.

The *stalks* are richer in nitrogen than the *stems* ranging from 3 to 4% nitrogen, but are considered poorer in potash. Tobacco is an exhausting crop, and the dust would prove an excellent fertilizer to apply to tobacco fields.

A ton of good tobacco stems should contain nitrogen equivalent to 500 pounds of nitrate of soda and potash equivalent to the amount contained in 200 pounds of sulphate of potash.

I have used hundreds of tons of tobacco dust in the past 20 years, and my faith in its fertilizing properties is unshaken, and could I procure it in any quantity in Jamaica, I would take all offering; but it is unprofitable to use unless finely ground, because, being so bulky in the form of stems, it becomes too expensive to haul and handle.

Tobacco dust is especially valuable as a fertilizer and insecticide for pine-apples, and it is the only safe article that can be used for dropping in the bud or heart of the plants; my plan is to go over the pine-apple fields after the suckers or slips have been planted 4 or 5 weeks and drop about a good pinch or two teaspoonsful into the heart of each plant; this acts as a splendid stimulant and kills the mealy bug and discourages ants from building their nests at the base of the plants, and whilst it will not kill ants, it will eventually drive them away for the want of mealy bugs to feed upon; the potash and ammonia contained in the dust will stimulate the plants and force them to make a vigorous growth and keep them free from insects and in a healthy condition.

THE LLEREN: A RARE ROOT CROP.*

By O. W. BARRETT.

Though perhaps one of the oldest cultivated plants, *Calathea Allouya* is almost unknown outside of the West Indies; it is occasionally cultivated in Trinidad and several other of the British Antilles but appears to attain its greatest development and popularity in Porto Rico.

* From *Plant World*, Vol VII, No. 6, June 1904.

Taxonomically it stands in the Zingiberaceae near *Phrynium*. In habit above ground it resembles the Turmeric (*Curcuma*) but has the pseudo-stem of *Amomum*; the subterranean habit is very similar to that of some of the *Phryniums*. According to Grisebach, the flower is small, white, and borne in roundish heads, like those of ginger—very unlike the large, fragrant, pale lilac, radical flower of *Calathea* (*Phrynium*) *zebrina*.

The clumping habit of the family is exemplified in the slow-spreading cluster of 10 to 25 loosely attached "heads," each of which bears a false stem composed of 4 to 8 erect, sheathing petioles. These "heads" may be considered as a kind of short stem, some 2 to 3 inches long and about 1 inch in diameter, or as a rhizome lying just beneath the surface of the soil and receiving at its base the roots and tuber stipes. New shoots are produced either from the tip of the "head" or from the side; thus the individual head is at least biennial while the clump is, of course, perennial. Growth ceases at the end of the rainy season, about December, and begins about April: the mat of dead leaves serves to protect the succulent, truncate "heads" from the fierce winter's sun.

The oblong-linear or linear-lanceolate leaf blade tapers abruptly at the tip but runs very gradually at the base into the slender, yellowish, channelled petiole. The strong veins, running at a rather small angle with the mid-rib, especially near the base, give the lamina a somewhat corrugated appearance; and though the petiole is always erect and rather stout, the mid-rib allows the long blade to droop gracefully.

Strong clumps growing in rich, cool soil or in partial shade attain a height of 3 or even 4 feet, the leaves from the central heads being much taller than those from the outside of the clump. By nature the Lleren is evidently a plant of the jungle and shaded river banks. At present it does not appear to grow wild anywhere in Porto Rico; like the "Yautia" (*Xanthosoma* spp.), it seems to have become through its hundreds of centuries of domestication an utter slave to human husbandry. In fact it rarely flowers and never (?) produces seed; while it is not impossible to find natives who will admit having seen the large "Yautia" (*Xanthosma*) flowers, I have been unable to find one who remembered seeing those of the Lleren.

The most important part of this interesting plant, however, is the peculiar tuber-like bodies which are borne on slender roots or stipes, from 3 to 6 inches beneath the soil surface. This pseudo-tuber is oval or elliptic in shape, from 1 to 2 inches in length, and covered with a thin smoothish cuticle of a pale yellowish colour; a few small rootlets are attached to the outer skin as well as to the stipe. The fact that no "eyes" are present precludes its being termed a tuber, but the abruptness with which it arises at the tip of the more or less specialized root which is not continued within the starch body, mark it as the limit of a root running tuberward. The centre of this body, to the extent of about one-third of the entire content, is occupied by a translucent

portion of a firm and crisp but gelatinous nature ; the main portion resembles the interior of the common potato but is finer-grained and much more gummy. Though the glutinous character disappears upon cooking, the crispness remains even after prolonged boiling.

The thin cuticle being removed after cooking, there appears a delicious morsel, snow-white outside, semi-transparent in the centre, which may be eaten as a side dish with butter, or, as many prefer, as a relish with salt, like radishes ; it is also good in soups. From December to May it is fairly common in the markets and is also frequently sold, cooked but not peeled, in the streets in the evening—a dozen or so tied in a bunch with the attached root-stems, at 1 cent. per bunch ; they thus take the place of pea-nuts.

The flavour of the Lleren is difficult to describe—there is certainly a taste like sweet-corn, and something quite its own besides. The surest thing about it is that if you try it once, you will again.

TANIER, THE OLDEST CROP.*

By O. W. BARRETT.

Of all the plants which made life possible to the wild men of old Caribea, the handiest was undoubtedly the Tanier. It grew in the loose alluvium along the forest streams and its tempting tubers were continually in evidence to the savage ancestors of the forefathers of the Arawaks. The idea of the goodness of these roots once grasped, a few worthless plants pulled out from among the edible ones, a sprouting tuber fragment purposely trodden into the soil—and agriculture was begun.

There is very good reason, as Mr. O. F. Cook has shown,† for believing that the cultivation of economic plants originated in Tropical America ; and in many ways the Tanier appears to have been cultivated longer than any other plant in this region. Nearly all the cultivated plants of the world readily produce seed ; but the Tanier, though flowering under favourable circumstances, has entirely lost its natural power to ripen seeds. Some varieties of the yam, the sweet potato, and even of the banana occasionally bear seeds in the home of the Tanier ; but many of their varieties have been introduced from other regions and their varieties are not so numerous in islands like Jamaica and Porto Rico as those of the Tanier.

As a vegetable slave this remarkable old crop has been spared the fate of most economics—exile from its own home ; for, strange as it may seem, the Tanier still remains almost unknown outside of Tropical America. Other food-plants have been carried to the far corners of the earth ; others less easily propagated and less productive, like the taro and the yam, have become staple

* From the *Plant World*, October 1904.

† "The American Origin of Agriculture," *Popular Science Monthly*, October, 1902.

articles in all hot countries, Central America included. This apparently paradoxical fact will undoubtedly be explained when the history of agriculture is better known.

The family Araceae is one of the most interesting and important in the realm of plants, the genus *Colocasia* alone includes about fifty edible varieties (the taros) and *Xanthosoma* (the taniers) holds about the same number of kinds. Until recently the taniers were confused with the taros, the usual local confusion of names helping to perpetuate the error even amongst those who must have known better. To be sure there is some similarity between the two plants in their appearance above ground, but the intrinsic characters of the leaves, flowers, and roots are very distinct.

Though its varieties have scores of names throughout Tropical America, "Yautia" is probably the oldest name of which we have any record; this was the general term applied by the aborigines when the Spaniards arrived in Porto Rico, the island which, from the first, was most famous for its agricultural advancement. And in this island has the "Yautia" reached its highest development—running here into some twenty distinct native varieties. About ten kinds are grown in the Windward Islands; northern South America has but very few; Cuba and Hayti have half a dozen or less; and the few varieties of Central America appear coarse and unproductive in comparison with the Porto Rican sorts. Taya, Tanier, or Cocoe are the common names in the British West Indies; in Cuba and Santo Domingo both Taro und Tanier are included under the name "Malanga;" while in the Central American republics it passes under almost as many names as there are Indian tribes.

Few plants yield a higher proportion of food material for the weight of the entire plant than does the Tanier; in fact fully 75 per cent. of the weight of some types is food. In the "Rollisa" variety of Porto Rico the tubers comprise about 35 per cent. of the weight of the living plant and the edible rootstock about 20 per cent. more; the young leaves are also edible, closely resembling spinach when boiled, but having more "body" and a richer flavour. The central stem, or rhizome, of many varieties is commonly eaten by the poorer classes but contains some fibre and only 15 to 20 per cent. of starch.

The obovoid or roundish tuberous roots are borne just below the surface of the soil, loosely attached at right angles to the central stem. In cropping, the leaves are grasped in the hands and the whole mass of tubers usually comes up with one good pull, and a quick shake will detach most of them from the parent root. Individual tubers weigh from a few ounces in some types to one and one-half or even two pounds in the better sorts. Each plant produces from two to four pounds, but since six thousand to ten thousand plants can be grown on an acre the yield is six to twenty tons of superior roots containing 20 per cent. to 30 per cent. of starch and little fibrous matter. Five to ten tons of the rhizomes, which may be utilized for feeding swine or for making starch,

may be added to these figures. By removing the first tubers as soon as ripe, by means of a "machete" and allowing the plant to remain *in situ* for six months longer, a second crop may be harvested; by this method, called "castration" in Trinidad, it is estimated that an acre of Tanier can be made to yield thirty tons of tubers at one planting; few crops can produce one half of this amount.

Though preferring rich, moist loam, the Tanier is content with almost any soil; like its near relative, the Taro, or Elephant's Ear, it revels in plenty of fresh water, but while the leaf development may be greater in wet situations the tuber percentage suffers. The leaves vary from pale green to deep mauve purple; in some sorts, like the "Palma," leaves three feet wide by four feet long are common. A Tanier field in its prime is a beautiful sight.

Boiled, fried, or baked, the better kinds of Tanier are superior to the Irish potato; though most varieties are not so "mealy" they are richer, firmer, and possess more distinct flavour. Most sorts are pure white, but four are pinkish purple, and several are of various shades of yellow. The roots keep fairly well after harvesting and would undoubtedly endure shipping to the Central States.

And now that the days of popular prejudice against anything new in the food line are dying out fortunately, we may expect to see the rare and royal old Tanier soon entering the northern markets and rapidly gaining favour as one of the best of many good things to come out of the Tropics. Twenty thousand years late but it will win!

RING-BARKING.

By A. TATHAM, Australia.*

Seeing what a vast amount of ring-barking has been performed in Australia in the past, it may seem somewhat of an anomaly to describe the process now. This article, it is hoped, will be of use to future operators, and tend to prevent, or at least lessen, some of the annoyances and expense usually connected with it. The subject will be discussed under the following heads:—

Why does ring-barking kill a tree?

How to ring-bark.

When to ring-bark.

Ring-barking compared with felling and burning-off.

WHY DOES RING-BARKING KILL A TREE?

The only way to answer this question is to describe the structure and functions of the roots, stem, and leaves of a tree. A tree cannot grow unless it gets moisture, as it is utterly incapable of getting nourishment from the soil except in a soluble form. The roots that perform this office are the very fine thread-like ones

*Agricultural Journal of Victoria, III, 9, 1905, p. 642.

found at the ends of the large ones. They are composed of elongated cells, the walls of which contain numerous thin spots on their surface. So thin are these that water can pass through them but absolutely nothing else, not the smallest particle of solid material, except the root is in any way injured. These cells are packed close together, and the thin spots in each coincide with those of the adjacent one. There is no opening whatever in their walls. So far, science has not actually proved exactly how moisture ascends to the leaves of a tree. As many cells are found in the stem that have such dense walls, it almost appears impossible for moisture to penetrate them. And yet it is by these cells in the stem that the sap ascends, the action being different to that of the root cells. Whenever two liquids of different densities are separated from each other by a membranous partition, it is nature's law that the denser fluid will attract the lighter, until both become the same density. This action is called endosmose. Now the cells in the roots of trees contain reserve material, stored there from the previous year's growth, and composed of mucilage and protoplasm, which is far denser than water. When the soil gets moist, the water in it is attracted through the cell walls to the denser liquid in the cell. This action goes on from cell to cell till it reaches the stem. Here capillary action starts. The sap ascends to the leaves, through the wood cells of the vascular bundles. These, in addition to other kinds of cells, form what is known as the sap-wood. The action of the rising sap is very rapid. As soon as it gets to the leaves it is elaborated and reverts again to the roots. The water taken up is largely evaporated by the leaves; the matter retained by them being the nourishment obtained from the soil, plus the reserve material from the roots. This at once causes a denseness of cell contents, that attracts the thinner rising sap, and so the action goes on till want of moisture in the soil prevents it. A tree, as is well known, is composed of two kinds of wood—heart and sap. The heartwood is to all intents and purposes dead, it takes no part in the life of the tree, other than to support the crown. It is in the heart that decay first sets in. It is possible for a tree to live for years with little or no heartwood, as may be seen in the case of a hollow one. The sapwood on the other hand, is the life of the tree, as by it the sap ascends and descends.

Having now seen how sap rises in a tree, the next and most important point is how does it come down, for it does come down, otherwise tree stems would never increase in girth. The leaves are the organs of nutrition, as well as respiration. The substance sent up by the roots has been utilized to form new shoots and leaves, in other words, height growth. As soon as warm weather sets in, the leaves begin to collect material from the atmosphere, mostly, carbon. Quite four-fifths of the carbon used in the structure of a tree is obtained in this way, the quantity used may be gauged by the amount of charcoal left after the wood has been burned. They also return to the atmosphere oxygen. The process of respiration is carried on through minute cells, found chiefly

on the under side of the leaf, called stomata. During dull, cold, or wet weather these cells are closed; but on a bright warm day they open, and the work of the tree growth is briskly carried on. The leaves collect the gases from the atmosphere, digest the carbon dioxide with the moisture, and dilute plant food from the roots, and pass it down along the branches and stem to them again. As this substance passes down, it takes a totally different course to the sap that came up. Instead of going down through the cells in the wood, it descends between the stem and the bark, and, as it does so, adheres to the stem, and gives birth to the cambium layer which forms the annual ring, or a year's growth of new wood. It is as well to remember this growth begins at the top of the tree; if it were not so, ring-barking would be work thrown away. The roots of the tree are also supplied with nutrition, which is stored in their cells, and is used the following season for future height growth. Having seen now the uses of the different parts of the tree and the system adopted by nature to keep life going, it is not very difficult to understand why ring-barking kills a tree. When a ring of bark is removed from the stem it severs, so to speak, the connection between the leaves and the roots. The downward flow of sap is voluminous, as well as rapid, and if only a narrow strip of bark be removed the wound is soon healed over. But let a broad band be taken, the sap, as a rule, cannot repair damages and the drying influence of the atmosphere and sunlight cause it to perish. But even this can be healed, if paper is wrapped round the ringed portion, so as to exclude air and light. Now, above the cut or ring, growth, still progresses. The root still send up sap. The leaves still send it down, but it cannot pass back to the roots. The roots are now isolated; they are unable to get nourishment for themselves, or to store up any for next season's growth. Their cells are at last emptied of nutriment. They contain only the material procured from the soil. Nature's law no longer acts. Passing up moisture to the leaves ceases, and the tree dies.

HOW TO RING BARK.

Although this operation is simplicity itself, still, unless care is taken it will result in endless trouble, and unnecessary expense. More especially in the case of young trees; in fact, the younger the tree the harder it is to kill, as a rule. Before describing the manner of doing the work, it will be as well to explain some often misquoted terms. *Suckers* are, strictly speaking, shoots that grow from the roots only, not from the stem. *Shoots* grow from the stem and branches. To ring bark properly, a band of bark should be removed from round the stem of the tree of sufficient width to prevent the possibility of the renewal of the bark. Not less than 10 inches is advisable, and in the case of gum trees 15 inches is not too much, as they seem to possess greater recuperative power than other trees. Great care should be taken that the bark is entirely removed, and that the stem of the tree is cut into as little as possible. It is advocated by some that to give a cut

into the stem tends to hasten the death of the tree; but it is not, as a rule, an economical system. First, by cutting into the sapwood, the rise of sap is arrested; not being able to get up to the leaves, it causes a dense mass of shoots to grow below the cut. These often take two stripping operations before the stump is killed. Second—the cutting into the wood, especially in young trees under 8 inches in diameter, causes them to be so weakened that the first gale breaks them off. The result is double work getting rid of the shoots, and also the fallen tree. It must be admitted that the tree-top often does die very quickly after this style of work; but as it is the roots that have to be killed, and as it fails to do so, it cannot be recommended. “More haste less speed,” is very applicable to ring-barking. Where trees of a large size have to be operated on, say 2 feet and over in diameter, what is often permissible, and, in fact, preferable, is to “chip-ring,” *i.e.* cut well into the sapwood; the death of the tree is speedy, and only in a few cases do shoots grow. The reasons for this are: A large or old tree has fewer dormant buds existing on the lower portion of the stem. The dormant buds are very numerous in young trees, and lie under the bark. It is one of nature’s provisions to enable a tree to recover in case of accident. In aged trees the germs of the buds may be buried by successive growths of wood, and the bark is thicker, especially near the ground. Again, an aged tree makes very little height, or circumference growth annually. Its energy is chiefly concentrated on the production of seed. This seed bearing is a severe tax on a tree, so much so, that, after bearing a crop, it takes two or more years to recover enough material to enable it to bear another. Therefore, when a tree of this description is ringed, it is not in a state to bear the shock, and a speedy death results. It often happens that an old tree, in spite of chip-ringing, still continues to live. This is caused by the existence of what is known as “internal bark.” When a tree has been severely wounded, and has renewed the bark over the place, decay will often commence under the bark on the wounded surface. The new bark will, so to speak, follow the decay trying to cover it, and, although the external appearance shows no indication of this and even after ringing it cannot be perceived, a strip of bark exists that connects the top and bottom of the cut. This is sufficient to upset all calculations, and if not rectified will enable the tree to make a good recovery. The only method is to fell a tree of this description. From the preceding remarks it may be gathered that in the case of young trees full of vitality, ring-barking is best, as it does not prevent the sap rising, and therefore enables the roots to exhaust themselves; but it allows no additional nourishment to return to them. In aged trees chip-ringing is permissible, the tree does not possess vitality or nutritive material enough to cope with the shock it receives.

WHEN TO RING-BARK.

This is undoubtedly the most important part of the operation. There can be no question, that the time for doing it is when the

sap is moving freely, so as to facilitate the removal of the bark. But as often as not the operation is undertaken too early in the season, the result being a dense growth of shoots, whereas if the ringing is left over till spring has set in, a speedier death of the tree is assured, few, if any, shoots are thrown, and most of the shoots will die, when the crown dies. Nourishment for the roots is only collected on warm, bright days, and it is highly probable that the storage of reserve material only takes place towards the end of summer. However, owing to climatic differences, no hard-and-fast rule can be laid down, for in the northern portions of Victoria, August might prove the best month; south of Dividing Range, September; whilst at an elevation of 1,000 feet or over, October.

RING-BARKING COMPARED WITH FELLING AND BURNING-OFF.

Both these systems have their advocates where small areas are concerned, but where the acreage runs into hundreds, only one is mentioned—ring-barking. Seeing the object in view is to destroy the timber, so as to allow sunlight into the soil, and so induce a growth of sweet grass, naturally the cheapest and quickest method is the one to be favoured.

Undoubtedly ring-barking is at first the cheapest, if not in the long run; but it is the slowest method. No good results can be looked for under twelve to fourteen months, and probably no really decent grazing can be expected under three years, unless a fire has run through the area. By the time the last tree has fallen, and the logs have been cleared up, can it be said to be a cheaper method than direct felling? Certainly the operation is spread over a number of years, therefore the annual outlay, especially as the necessary work can be done in slack seasons, is often so slight, that it can almost be made to appear an inexpensive system. Hence its adaptability to the requirements of the usual run of graziers. It has many disadvantages; the incessant accumulation of rubbish by windfalls, and especially after a fire; the greater danger of fire being carried from dead tree to dead tree, with the least chance of stopping or preventing it; the great harbour it affords to rabbits, attracted by the grass and sheltered by the decaying roots and logs, and the least chance of eradicating them; and the surprising growth of seedlings that takes place, which, if not destroyed in the earliest stages of growth give endless trouble, and often lead to the abandoning of the area. On the other hand, in some districts the resulting firewood has a not insignificant market value, so much so, that instances are not wanting in which, after deducting all charges connected with ringing of trees, and cutting of fuel, a balance has been left of ten shillings and more per acre. The humus caused by ages of decayed vegetation, and the addition of the leaves and twigs of the rung timber, must add materially to the value of the land, and though at first is often detrimental to a sweet growth of grass, will eventually cause a thick sward to form.

Felling and Burning-off.—As a rule, this is only practised on small areas, its initial cost being far too heavy to suit most selec-

tors. Its chief advantage is that in twelve or fifteen months, work can be accomplished equal to ten years or more where ring-barking is done. It has the further advantage of affording a quick growth of sweet grass, especially if seed has been sown broadcast over the ashes of the burn, as ought always to be done. Its disadvantages are its first cost; its destruction of what is often a marketable commodity, the resulting firewood is too charred to be acceptable for household purposes, and very little remains if the work is properly done. The intense heat of the fire destroys the humus layer, even burning into the soil in places. These patches of burnt ground, especially where piling has taken place, are often the cause of the introduction of one of the worst pests to the grazier in the cooler and moist districts—the bracken fern. Its spores are blown considerable distances by wind, and find the best of material for germinating on when they strike a patch of burnt earth or charcoal debris. Grass, on the other hand, avoids the severely burnt patches. The burning-off is also a source of great danger to neighbouring properties.

Ring-barking, prior to burning of the dense undergrowth, is a good method where practicable. In districts like Gippsland, a lot of rubbish is destroyed, including shoots from the trees. But it may not always be possible to combine the two, the undergrowth being too dense to permit of ringing till after the burn.

An argument is often put forward in favour of ring-barking, as compared to felling or grubbing, and that is the loss of "goodness" to the soil. It is maintained that a ringed tree returns something to the soil, which is lost to it otherwise. Such a theory cannot be accepted, except it be that the resulting decaying debris acts as a top dressing, in other words, humus. If a tree can directly return "goodness," then the object of ring-barking will fail. The tree grows from the top downwards. The operation of ringing, if successful, is as effectual in severing connection between head and root as felling would be. Even allowing the possibility of such an action, its influence would be restricted to the roots and the soil directly surrounding them. If any reason exists for the better growth of grass near stumps or on sites previously occupied by them, it may be put down to the influence of decayed vegetable matter, and the, so to speak, trenching operations, caused by the roots of the tree having given the soil an upward lift as they increased in size.

This article is written after a series of experiments, extending over three years. The question, when to ring-bark, may not be actually proved to satisfy all districts and species of trees. But it is hoped that the remarks made, may, in addition to the experiences gained by others, assist future operators and lessen the often tedious work.

FORESTS AND RIVERS.*

At the recent meeting of the International Navigation Congress at Milan, one of the questions taken into consideration was "the influence which the destruction of forests and the desiccation of marshes has upon the *régime* and discharge of rivers," and seven papers bearing on the subject were read and discussed. Of these, three were from Austria, and the others from Germany, France, and Russia. The problem as to the effect of forests on the water supply of rivers and on climate is of great social importance on account of the agricultural and commercial interests which are so closely connected with the use of timber, and with the utilisation of running water.

It is allowed by all the authors of these papers that, due to the improvident way in which the forests have been dealt with, there has been a marked change in the water supply of the neighbouring rivers; that where forests have been cut down brooks have disappeared, and many small rivers that at one time were useful as sources of power are so no longer for want of water; that in the larger rivers torrents have become more impetuous, and flooding more frequent; while, on the other hand, navigation suffers at times for want of water.

The greatest harm has been done in the mountain districts, where the steep slopes allow the rain-water to run off too rapidly, carrying away the surface soil and transporting pebbles and boulders into the rivers, causing shoals, thus decreasing their capacity to discharge the flood water.

The extent to which forests, both on the Continent and in America, are being cut down and destroyed, and large areas of land, which at one time were covered with primæval forest, have become barren wastes by fire or the lumberman's axe without any attempt at re-forestation, was one of the subjects dealt with in the presidential address of Mr. J. C. Hawkshaw at the Institution of Civil Engineers in 1902. Mr. Hawkshaw pointed out that, notwithstanding the displacement of wood in building structures by iron, yet large quantities of timber are still required, not only for building purposes, but for temporary structures, such as coffer dams and scaffolding; pit props for mining; sleepers required for the railways, which, in this country, he estimated at an annual value of 18 million pounds, and those required for renewals at three-quarters of a million pounds; while for the railway service of the united States there are required 15 millions of acres of forest land to maintain a supply of sleepers.

The question for consideration at the Congress was whether the wholesale destruction of forest land for cultivation or for timber supply is having any material effect on the rainfall and consequent water supply; and the effect of forest destruction on the rivers of the country from which the trees are removed was also considered.

* From "Nature." February 1, 1906,

The physical conditions of forest land are that, owing to the shelter from sun and wind, the atmosphere is generally colder and damper than in the open country, and evaporation consequently less. It is calculated that a hectare of forest land (2½ acres) gives off every day 37 cubic metres of oxygen and 37 metres of carbonic acid, leading to a great expenditure of heat; and that from every hectare of forest land sufficient heat is abstracted to melt 316 cubic metres of ice. Ligneous plants also withdraw from the ground and discharge as vapour more than 40,000 gallons of water per hectare per day, which causes a sensible reduction of temperature. When clouds pass over a forest they encounter a cool, damp atmosphere, the point of saturation comes closer, and rain is caused. This condition of forest land has been remarked on by aëronauts, who find that a balloon is invariably affected, and drops when passing over forests.

The advantages claimed for forests with regard to water supply are that the trees act as regulators of the rainfall; that the average quantity of rain falling on land covered with forests is greater than in the open ground to the extent of about one-sixth; that it holds up the water for a time and discharges it later on when water is most required in river basins, the rain being held back by the leaves of the trees and coming to the ground more gradually; the rain that falls on the surface is also taken up by the layer of dead leaves on the ground, which permits of a gradual percolation to the sub-soil. Observations show that in summer the ground of the forest is damper than that of the adjacent cleared land, and snow remains for a much longer period in forest land before melting than in cleared land.

On the other hand, it has been contended by some of those who have made a study of silviculture that forests do not increase the quantity of water flowing to the springs and rivers, but reduce it. The numerous striking facts quoted do not bear out this contention, which is mainly based on the fact that the substratum water stands at a lower level on forest land than in the adjacent cleared ground. This fact is generally admitted to be the case at one period of the year. As the result of many years' observations, it has been found that the maximum level of underground water is reached in May, that the water accumulates in the ground from August to January; and that the rivers are supplied by this reserve, and were it not for this accumulation many brooks and river feeders would cease to flow in summer.

Several very striking examples are given by the authors of the papers as to the deleterious effects of cutting down forests, especially in hilly districts. In the commune of La Bruguière, the forests on the slopes of the Black Mountain were cut down; the consequence of this removal of the trees was that a brook which ran at the foot, and the water from which was used for driving some fulling mills, became so dried up in summer as no longer to be of any use, while in winter the sudden floods caused very great damage in the valley. The forests were re-planted, and as the

trees grew up the water coming to the brook was so regulated as to serve its former useful purpose in driving the mills, and the torrents in winter were moderated. Several other examples of a similar character are given.

In Switzerland, amongst other examples is quoted one that occurred in the canton of Berne, where, owing to the re-planting of the mountain-side with fir trees, the water again appeared at a spring which had ceased to flow. After a period the trees were cut down and the land converted into pasturage, since when the spring has almost disappeared only opening out at occasional intervals.

In the Kazan district of Russia, once celebrated for its forests of oaks and linden, which are now nearly all cut down, there were formerly seventy water-mills constantly at work. Less than half now can be worked, and even they only run half time, and are idle in summer for want of water; while in winter the little rivers that worked these mills are converted into impetuous torrents, breaking up the mill dams and doing other damage. These abandoned water-mills stand out as a striking proof of the consequences of the destruction of forests.

In Sardinia, where the surface consists of plutonic rocks covered with a thin layer of earth, all the streams have a rapid slope. The woods, which occupied in 1870 an area of more than $2\frac{1}{2}$ million acres, or about 43 per cent. of the whole surface of the island, now are reduced to about one-sixteenth of this area. Since the removal of the trees the floods in the rivers rise with a rapidity and flow with a velocity never known before, and a great number of bridges have been destroyed by the floods. The beds of the channels have been raised in some places above the surface of the land, owing to the detritus brought down in floods.

In Wisconsin, U.S.A., the settlers cut down the forests and converted the land into tillage and pasture. During a period of about seventy years nearly the whole of the forest land was thus cleared with the result that, as the forest disappeared, the water in the river became lower; finally thirty miles of the channel entirely dried up, and many water-mills that were formerly worked by the stream are now deserted and useless, owing to the want of water to run them.

In Sicily, owing to the cutting down of the forests on a vast scale in the province of Messina, the bed of the river has been raised by the stones and earth carried down by the torrents so as to stop all drainage from the land, and great damage has been done by the floods. Several other examples are given to the same effect where forests have been cleared in the same district, and these are compared with other streams where the forests still exists and their condition remains unaltered. In the former case, landslides from the mountains have become very frequent.

BOARD OF AGRICULTURE.

EXTRACTS FROM MINUTES.

The usual monthly meeting of the Board of Agriculture was held at Headquarter House on Wednesday, 11th July, 1906. Present:—The Hon. T. L. Roxburgh, Acting Colonial Secretary in the chair; the acting Director of Public Gardens, the acting Isand Chemist; the Superintending Inspector of Schools, Messrs. C. A. T. Fursdon, J. W. Middleton, G. D. Murray and the Secretary.

His Grace the Archbishop sent an apology for absence, as he would be away in Trelawny and St. Ann for 11 or 12 days.

No Truck System—The Secretary submitted a letter from the Westmoreland Sugar Planters' Association with reference to the matter of estates compelling labourers to purchase bread, beef and pork from the estates, saying that the Association was not aware of any estates doing so.

The Secretary was instructed to acknowledge receipt of the letter, and he was also instructed to write the Colonial Secretary that the Board had not been able to find out that the practice complained of existed on more than the estate given.

Official Letters—The Secretary read the following letters from the Colonial Secretary's office :—

1. *Re Agricultural Instructors*, that the suggestions of the Board with regard to the Instructors, to be employed with the £500 from Elder, Dempster & Co. would be conveyed to the Agricultural Society.

2. *Re Asst. Superintendent at Hope Gardens*, that the Governor has already approved of the employment of foreman Taylor temporarily as Agricultural Instructor at the Experiment Station at a salary of £100 a year, and that the matter of permanently filling the post of Asst. Superintendent would be considered with the estimates for 1907-08 : and that His Excellency had authorised the Director of Public Gardens to insert £150 as salary for the officer to be selected.

Mr. Middleton moved that a committee be appointed to go more thoroughly into the matter and report to the Board. This was agreed to and Mr. Middleton and Mr. Fursdon were appointed.

3. *Standard of Rum*.—Sending copy of minute by the Chemist *re* standard quantity of ethers for Jamaica rum.

It was agreed that the Secretary should acknowledge receipt of the letter, and say that the Board would allow the consideration of this matter to lie over for a time.

4. *School Gardens*—Special grants to school gardens; referring minutes by the Superintending Inspector of Schools and the Director of Public Gardens on the matter.

The Secretary was instructed to reply that the Board would approve of the transfer of £30 under the allocation for model gardens

from the estimates of the Public Gardens to the amount on the estimates of the Education Department for school gardens and would approve of there being one vote in future for this purpose, and that should be on the estimates of the Education Department.

Course Postponed.—The Secretary submitted a letter from the Island Chemist to the acting Chairman, stating that owing to the recent heavy rains sugar crops were so backward that many distillers would not be able to attend the Distillers' Course as arranged; that he was convinced that the only way was to postpone the Course to October 8th to 26th when Mr. Allan would be able to take part, and if his (the Chemist's) leave commenced on July 5th he would get back in time for the Course. As the matter was urgent he asked the acting Chairman to approve, which had been done.

The Board approved of the action taken.

Reports Presented.—The following reports from the Chemist's Department were submitted :—

1. Postponement of Distillers' Course.
2. Work of Agricultural Lecturer.
3. Suggestion by Mr. Cousins that he be permitted to visit various centres in Great Britain and Germany in the interest of Jamaica rum, to be on half pay for a fortnight, his travelling expenses from London as a centre to be paid from the Laboratory allowance for travelling, and asking that the Colonial Office in London be requested to furnish him with introductions to the British Consuls at Bremen and Hamburg.

It was agreed to inform the Colonial Secretary's Office of the proposals and that the Board approved of them.

4. Proof of Chart of "Agricultural Don'ts" for approval. With some alterations in the type of printing, this was approved of.

Reports 1 and 2 were directed to be circulated.

The following reports from the Director of Public Gardens were submitted :—

1. Hope Experiment Station.
2. Instructors.

These were directed to be circulated.

The meeting adjourned till Wednesday, 15th August at 2 p.m.

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